

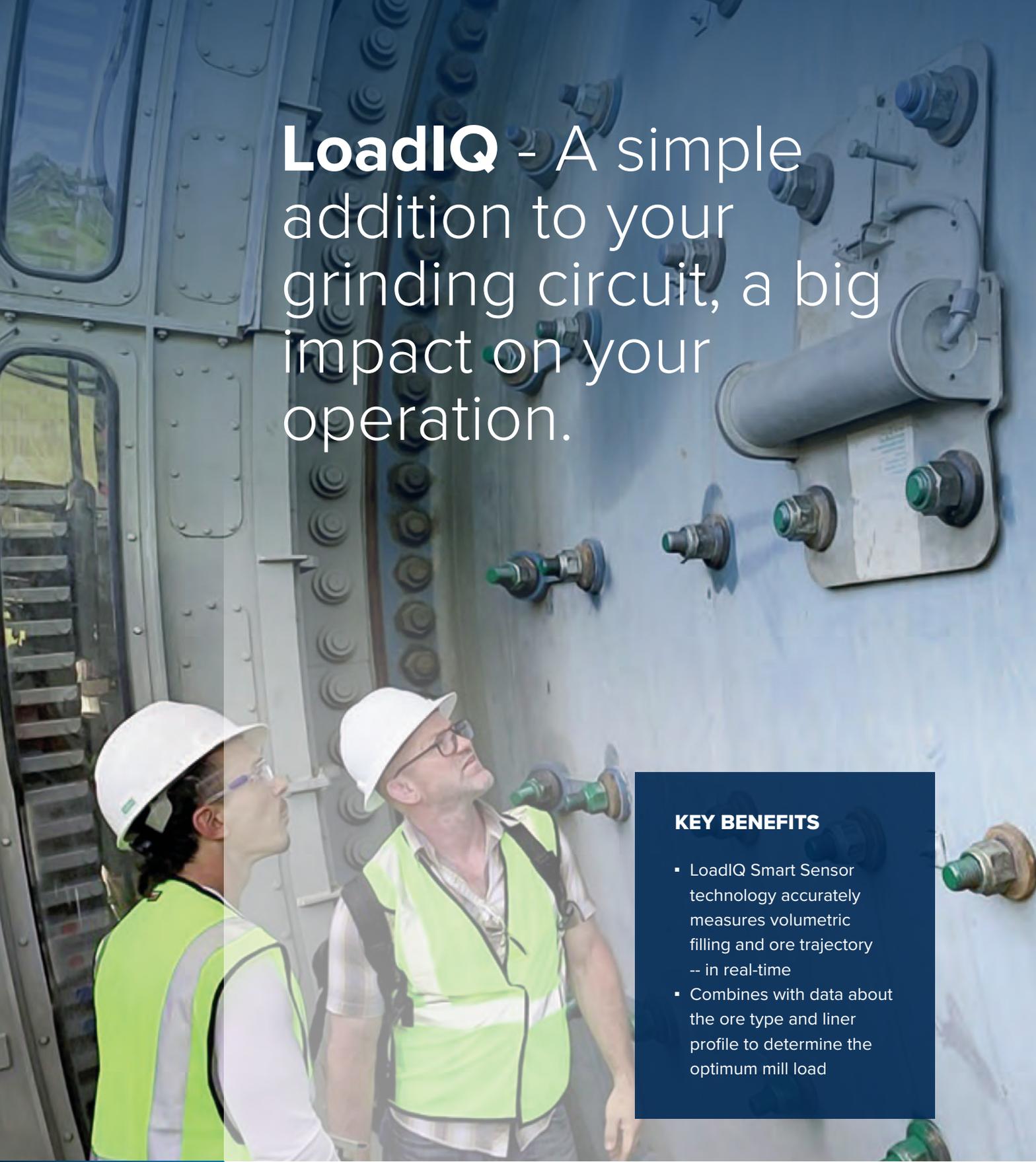
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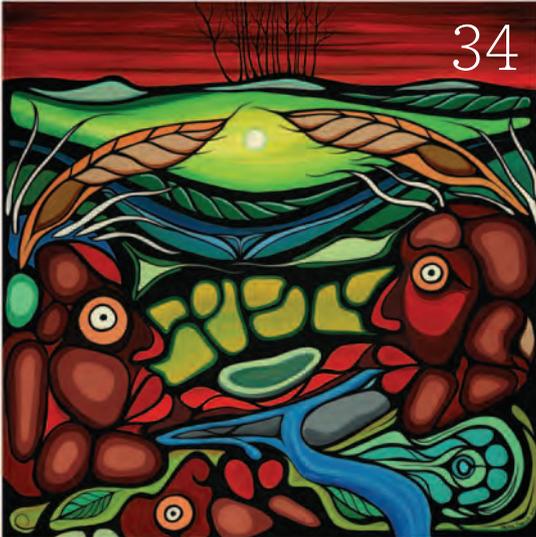
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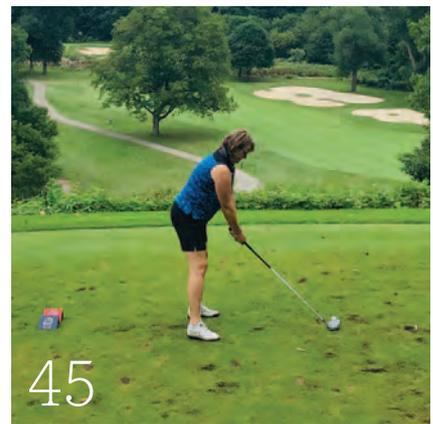
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Par Tijana Mitrovic

Bench strength

A very useful development for this page of the magazine is the return of beer league hockey. After an aborted 2020-2021 season, which lasted only a few weeks, we are double vaccinated and lacing up the skates again.

Getting back to the rink is the chance to catch up with a hockey buddy who happens to work in the industry. His technical training was not mining-specific, but the work assignments from his engineering firm have had him going to mine projects across Quebec over the last decade.

In this instance, he was back from Val d'Or just in time for our season opener, and his dressing room update added some colour to the common sentiment I hear regularly in Zoom meetings, the industry needs more people.

Even before the pandemic and the run up of the gold price, Val d'Or had a tight labour market. Now, he reported, he has never seen it so busy, with more people than the town's hotels and restaurants can handle. This spring the unemployment rate in the region had sunk as low as 3.5 per cent.

That is the same level as in the natural resources sector nationwide, according to a recent presentation Ryan Montpellier of the Mining Industry Human Resources Council (MiHR) gave to CIM Council. Baby boomers are retiring, projects are getting funded (not the least of which is BHP's Jansen potash project, pg. 11) and the pool of experienced workers is drying up.

"A proven team" is essential for a mine project," writes Ian Pearce in his column, "Five critical requirements for capital project success" (pg. 24). Today, however, the years of experience outlined in many job descriptions may be wishful thinking. The industry is running an HR deficit and, based on the MiHR presentation, this cloud in the otherwise bright outlook for mining will persist. Employers will have to fill out project teams with those who show promise rather than have a proven record.

This was the case for my friend, who told me that he was being pursued for a position at a mine project that, he said, would have him skipping a couple rungs of the career ladder.

Addressing the HR shortage will depend on a spectrum of solutions – outreach, engagement, mentorship, collaboration, strategic professional development options and knowledge sharing. I sincerely hope for both the employers and employees thrust into new roles that the ingenuity required to bring projects to completion will also be brought to bear in selecting and guiding the teams dedicated to building the next generation of mines.

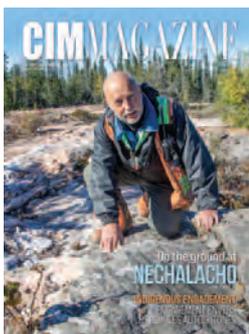
This challenge will inevitably be one of the topics addressed at the upcoming Capital Projects Symposium set for November, in Toronto.

The event presents an opportunity to bring together project leaders with prospective team members seeking out the expertise and the network required to bridge the gap between where they are in their careers and where the industry needs them to be.

The inaugural event held online last year was an excellent, focused forum on the challenges of and strategies for project execution. This year, face-to-face networking will be a welcome dimension to the experience. It is a great addition to the slate of CIM events and one I intend to be a part of, even if it has me missing out on my ice-time.



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This issue's cover

Chris Pedersen, consulting geologist and discoverer of Nechalacho, at the discovery site.

Courtesy of Cheetah Resources/
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CIM brings together the collective knowledge required to improve the success rate of capital projects.

Capitalizing on our resources

CIM's strategic vision is to be the trusted authority and collective source for advancing mineral industry knowledge, guidelines and best practices. In support of this vision, CIM is excited to be moving forward with the second annual Capital Projects Symposium.

The oft quoted statistic from McKinsey's 2017 report states that "more than four out of five mining projects come in late and over budget, by an average of 43 per cent." As an industry, we have not exactly been shooting the lights out when it comes to delivering projects that meet or exceed the economic or societal targets that were promised to stakeholders.

The good news is that about 20 per cent of projects *are* successful. They are built on time, within budget, ramp-up quickly and meet the promised net present value (NPV) targets. The evidence is there. We have and can successfully deliver projects!

The question is, how do we get the other 80 per cent of projects to be successful? This is not a new question or topic. Terry McNulty's seminal paper from 1998 gave us great insight into the factors that contribute to NPV destruction. A quick Google search

will find you a multitude of papers and studies that have attempted to quantify what is required to successfully deliver mining projects. One will find that many of these studies focus on specific aspects of the project, especially the execution.

The bottom line is that mining projects are complex and require the input and collaboration of multiple technical, financial and operations experts at various stages of the project development. CIM, with its 11 technical societies spanning all of these areas of expertise, is well suited to bring together the collective knowledge required and to develop the best practices needed to improve our project success rate, and thus improve the reputation of our industry.

We need to bring all of these professionals together to share experience and knowledge. To this end, we would like to invite you to join us this November in Toronto for the second annual Capital Projects Symposium, the only global industry event that focuses 100 per cent on mining projects. For more information, visit capitalprojects.cim.org.

A handwritten signature in black ink, appearing to read 'PJ', enclosed in a light gray rectangular box.

Pierre Julien
CIM President

Courtesy of Hard-Line



Breakthrough automation

Hard-Line's Auto Rockbreaker gives companies the ability to automate many rock breaking tasks that had never previously been automated. According to Hard-Line, the Auto Rockbreaker uses a suite of sensors, such as LiDAR and cameras, to see the environment and machine learning algorithms to process and understand the ground environment. By automating these tasks, the company says that miners will be able to save on maintenance and training costs. Senior vice-president of technology at Hard-Line Ryan Siggelkow said, "If the functions are more deliberate, we can move the machine in a way that makes sense for the machine itself, and also lower the damage and the downtime on the equipment." With self-contained hardware, the entire system is housed at the breaker site.

Conveyor training

Martin Engineering's Online Conveyor Training for Learning Management Systems (LMS) provides training without the expenses of travel for miners. Training manager Jerad Heitzler said, "Online conveyor training is delivering critical knowledge to companies around the world, and that's never been more important than in these pandemic-restricted times." The training includes eight self-paced modules that address methods to identify, understand and correct common bulk conveying issues to improve safety on powerful and potentially dangerous systems, while complying with regulations, maximizing production efficiency and achieving the lowest operating costs.



Courtesy of Martin Engineering

Underground utility

MineMaster's new underground Mine Tractor MMT4 is a utility tractor that can be configured for a variety of underground jobs, reducing the number of mobile equipment units required for operations. Operations manager Jake Gougeon said, "A big advantage is configurability. A lot of sites and contractors want these tractors to be like a Swiss Army knife, they don't want a single-purpose vehicle." The multipurpose machine can be configured with a rear backhoe, rear shotcrete spray arm, personnel carrier, jib crane, scissor lift and more. "This way they can retool for other jobs without incurring lots of costs. A lot of other products on the market are more rigid, in that you'd have to do a lot of welding and cutting if you'd like to reconfigure," Gougeon said.



Courtesy of MineMaster

Compiled by Angelica Zagorski

Developments

The specs on SPACS

The mining world is turning to special purpose acquisition companies when big deals are on the line

By Carolyn Gruske

The two companies could not be more different if they tried. Algoma Steel in Sault Ste. Marie, Ontario, has been in business since 1901 and currently has the capacity to produce four million tonnes of hot and cold rolled steel for automotive, mining, ship building, rail and military customers. Based in Vancouver, Deep Green Metals was a start-up founded with the intent of harvesting polymetallic nodules from the seafloor of the Pacific Ocean to supply metals to the electric vehicle battery market. Despite their differences, however, both companies decided to turn to SPACs on the way to becoming publicly traded companies.

SPACs, or special purpose acquisition companies, are also known as “blank cheque” companies. They produce no goods and offer no services. Essentially, they are corporate entities that exist solely as investment vehicles. They have mandates to seek out businesses, merge with them, and take them public.

SPACs are not new, but over the course of the last 18 months or so, they have gained popularity, especially in the mining industry. Deep Green found a SPAC partner, Sustainable Opportunities Acquisition Corp., in March and after a US\$2.9 billion deal, The Metals Company emerged. On Sept. 10, it began trading on the Nasdaq Global Select Market.

Legato Merger, a U.S.-based SPAC headed up by partners David Sgro and Eric Rosenfeld, merged with Algoma Steel. That deal, which happened in May, valued the company at \$1.7 billion, and saw Algoma receiving \$306 million of capital, including a \$100 million fully committed private placement with key investors.

Deals involving SPACs are large deals, and that is by design. As Michelle Grant,



Courtesy of Wikipedia

Looking to go public, Algoma Steel made a deal with U.S.-based SPAC Legato Merger.

national energy, utilities, mining and industrial deals leader for PwC explained, the minimum amount that can be raised to fund a SPAC is \$30 million, and that is money that needs to be spent on what is known as a qualifying transaction (QT) – that is, buying (or merging with) the company that wants to go public.

“For a SPAC deal, what happens is 90 per cent of the money that’s raised goes into escrow. And has to be used to fund the qualifying transaction. Those are the requirements that are put on SPAC [by the stock exchanges that regulate SPACs]... The qualifying transaction in a SPAC has to be at least 80 per cent of the escrow value,” said Grant. She gave the example that for a SPAC looking to spend \$30 million, the company it wants to

invest in needs to have a business valuation of at least \$24 million.

The number of SPAC deals in Canada is still pretty low. According to Grant, a TSX report from May showed that there were only three SPACs listed on the exchange. Part of the reason why is that the number of private Canadian companies valued at \$30 million-plus is limited. In the mining industry, in particular, Canada is better known for juniors and for the investment tools that support them, specifically capital pool companies (CPCs).

“A lot of the times the companies looking to go public are juniors looking to raise exploration capital, so we’re not talking about hundreds of millions of dollars like the SPACs we see in the U.S. Usually, those types of deals are true

M&A deals with actual acquisitions by large Canadian public companies,” explained Kevin Chan, PwC’s national mining leader.

“The need to fund junior exploration companies necessitates that lower transaction threshold. Which is why, at least in the Canadian market, you’ll see the CPC route more so than a SPAC. But if your definition of a SPAC is just a shell company with cash that facilitates a takeover to allow a private company to go public, a CPC is, in a way, a SPAC. It’s just not a formal SPAC as defined by the TSX.”

Legato’s Sgro also emphasized the importance of CPCs. “The CPC structure in Canada is one that tends to be used more heavily. It’s not something that is used in the U.S. market. I think it is a reason why there hasn’t been as much activity from SPACs in Canada.”

While they may not be as common as CPCs, there is no reason why Canadian companies could not catch the eye of international SPAC executives.

“We know there are groups looking at the Canadian market and we know there are groups looking at targets here

as well. I think that there will be activity in the sector, just based on things that we’re seeing and a few of the people that we’ve been talking to,” said Norbert Knutel, a Toronto-based partner at the law firm Blake, Cassels & Graydon LLP.

Most importantly, whether it is a SPAC or a CPC, Grant said that it benefits mining companies to understand how these investment pools work, and what the consequences are of getting involved.

Long-awaited BHP Jansen potash project approved

After billions of dollars spent and a series of delays from decreases in profit and production due to the effects of the COVID-19 pandemic, BHP’s Jansen potash project has officially been approved. BHP’s US\$5.7 billion investment in the Jansen stage one project is part of the company’s plan to access “future-facing commodities,” according to BHP. The mine, 45 kilometres south-

“Is going public right for the mining company? That’s really an important question because the answer to that question could very easily be no,” Grant told *CIM Magazine*. “The SPACs and the CPCs are out there hunting for qualified transactions. It might look like an attractive deal, but it might not be the right thing for the company to do, to go public. You need to make that holistic assessment and make sure that it’s the right time.” **CIM**

east of Humboldt, Saskatchewan, is expected to be one of the world’s most sustainable potash mines with a low carbon footprint and low water intensity.

In the same vein, BHP also recently submitted and was approved for a public offer to acquire Canada’s Noront Resources to gain access to a highly prospective nickel basin.

Chief executive officer Mike Henry said, “the world will need more copper and nickel for electrification, renewable power and electric vehicles, iron ore and

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Jansen is expected to produce 4.35 million tonnes of potash per year.

high-quality metallurgical coal to produce the steel for infrastructure, including that required for decarbonization, and the potash required for sustainable global food production.”

“We are actively positioning BHP to meet the world’s needs and to continue to sustainably generate value for our shareholders, employees and business partners, as well as for our host communities and governments,” Henry said.

FROM THE WIRE

Compiled by Angelica Zagorski

Sherritt International has appointed **Greg Honig** as chief commercial officer, **Yasmin Gabriel** as chief financial officer, and **Chad Ross** as chief human resources officer. Honig has 18 years of experience in the mining industry at Resource Capital Funds, Noront Resources, and more. Gabriel is a financial leader with 15 years of experience in her field, including 11 years in mining. Ross joined Sherritt in 2011 and has an extensive financial background.

Sunny Lowe joins Solaris Resources as its new chief financial officer. Lowe has previously worked as vice-president, finance and vice-president, internal audit and enterprise risk management for senior precious metal producers.

BHP and Westshore Terminals Limited Partnership have also entered a conditional agreement to provide services for the mine. Westshore will construct the necessary infrastructure to provide port services to Jansen until 2051, with the potential for extension.

During peak construction, the mine will create 3,500 jobs, with 600 ongoing jobs after construction. BHP has made a statement that the mine will create opportunities for local Indigenous businesses, and First Nations employees will make up 20 per cent of the workforce.

Jansen stage one is expected to produce approximately 4.35 million tonnes of potash per year. The site has the potential for further expansions in the future, according to BHP. Construction for the site is estimated at six years.

“This is an important milestone for BHP and an investment in a new commodity that we believe will create value for shareholders for generations,” Henry said.

– Angelica Zagorski

New agreement ends union strike at Vale’s Sudbury mines

A two-month strike at Vale’s Sudbury nickel and copper operations came to an end Aug. 3, with a new deal inked between the mining company and the members of the United Steelworkers (USW) Local 6500.

Eighty-five per cent of the over 2,500 unionized steelworkers voted in favour of a new five-year collective agreement, which, effective immediately, will improve employee wages, benefits and health coverage.

“The past two months have been challenging for everyone,” Dino Otranto, Vale’s chief operating officer of North Atlantic Operations said. “We are pleased that the company and the union were able to find common ground and a path forward. We look forward to welcoming everyone back.”

Vale had previously presented two other wage deals to the members of the USW 6500, but both were swiftly rejected and prompted the picket lines to go up on June 1.

“To be honest, the workers were actually quite insulted by the original offer the company had put on the table,” Kevin Boyd, USW Local 6500 vice-president, said.

The largest point of contention, according to Boyd, was that Vale was trying to eliminate the existing post-retirement health benefits for all new hires. Instead, the mining giant was offering all future hires a \$1,000 post-retirement “health-care savings account,” which would see new workers lose almost 80 per cent of the coverage that was being provided under the current plan. The proposal would have also removed coverage on certain medications and medical supplies.

“The work that we do, as much as we try to make it as safe as possible for our [members] in those plants, mines and service plants, there are dangers. There are chemicals, there are repetitive strain injuries and all sorts of hazards that can have long-term effects,” explained Boyd. “We need something to help take care of our bodies after we retire to have any type of quality of life.”

The new five-year agreement was eventually settled with the aid of a third-party facilitator that was brought in to help foster negotiations on July 19. The deal now comes with a six per cent wage increase over five years, with additional cost-of-living adjustments; a \$2,500 recognition payment to be made in August, acknowledging the work done throughout the COVID-19 pandemic; a \$3,500 signing bonus to be paid in September; the continuation of over-the-counter drug coverage; and notably, the preserva-

tion of the retiree health benefits for all future hires.

“When we looked at this offer that was ratified, it actually checked off all the boxes...[for] our membership [to] move forward. So, it satisfied what we were looking for,” said Boyd.

If it hadn’t, he added that the workers were prepared to continue picketing. “By no means did the membership get tired of being on strike. There was a lot of support to say ‘Hey, I’m ready to stay out another year if I have to, to make sure we take care of the future generations because that is what those benefits are about.’”

Vale’s operations in Sudbury include five mines, a mill, a smelter, a refinery and almost 4,000 employees, making it one of the world’s largest integrated mining complexes. Moving forward, Otranto said the company will be focusing on positioning itself to “thrive today and for generations to come.”

“We have many opportunities ahead of us, with the growing electric vehicle market,” he said. “The nickel, copper and cobalt we produce are critical metals to



Courtesy of Vale

After two months of striking, the United Steelworkers 6500 approved a new five-year collective agreement.

achieving a low-carbon future. What we produce, and how we produce it, matters and our collective success going forward

will require collaboration to make this business successful for us all.”

– Mehanaz Yakub

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ICMM focuses on transparency with new water reporting guidance

The new guidance is designed to offer a better understanding of mines' water usage to interested stakeholders

By Matthew Parizot

The mining industry's relationship with water is very complex. Mines are dependent on water sources for numerous aspects of operation, including mineral processing, but these operations can also pose risks to the health of nearby bodies of water through leaching of minerals, a common concern that can impact permit approval, social licence and stakeholder approval.

To help mining companies properly disclose their water usage, on Aug. 25 the International Council on Mining and Metals (ICMM) published an updated version of its water reporting guidance. According to the ICMM, the new guidance, titled "Water Reporting: Good practice guide," is designed to improve the quality and consistency of corporate water reporting, which in turn will allow stakeholders to improve their understanding and ability to use said reports.

Building on the first edition of the guidance from 2017, the new version adjusts the definitions and reporting requirements to match water reporting guidance from other organizations such as CDP or the Global Reporting Initiative. In a webinar following the announcement of the updated guidance, ICMM COO Aidan Davy explained that these new standards necessitated an updated version of the guidance.

"Beyond these external [guidelines], it became clear that some of the metrics from the 2017 guide were open to different interpretations that ran contrary to our goal of consistent water reporting," Davy said. "The revised version of the work is very much designed to support the industry's commitment to consistent reporting. Through its application, companies will provide a more comprehensive picture on their water risks and opportunities, and they can demonstrate that they are responsible water stewards, and respond to calls for more, and increasingly granular, data."

In addition to aligning with other standards, the guidance also broadens



Courtesy of Vale

The new guidance will help operators align their water reporting with other commonly used external standards.

the minimum reporting requirements so that companies must give detailed narrative explanations and metric volume of their operations' interactions with water – including water uses, sources and discharges – possible water risks and opportunities, as well as the companies' commitment to water stewardship. According to Newmont group executive of environment Briana Gunn, this will allow companies to better inform stakeholders and increase transparency.

"There were a number of discrepancies in the way companies were reporting externally on the information that we had in terms of water, specifically around water consumption," Gunn said. "So what's happened with the framing guidance is, I think, we've been able to align and provide a bit of flexibility for how the companies put information in, and to have something that is way more comparable and transparent than we previously had."

These requirements will apply to all of ICMM's 28 member companies,

which include mining giants such as BHP, Barrick, Teck and Glencore. While the focus on improved transparency will benefit interested stakeholders, it will also benefit the companies in terms of engaging the communities affected by water usage.

"When it comes to water, what's interesting about it is, it's a shared resource that's ultimately valued by different parties in different manners," World Wildlife Federation global water stewardship lead Alexis Morgan said. "Water is, to some people, an economic risk and opportunity. To others it's a fundamental human right, but to many others it also has a spiritual value and various other values. So providing transparent information really allows people to share information in a way that's consistent and can be interpreted, and I think that that sharing of information is actually quite fundamental to an exercise of not only understanding, but trust building and relationship creation." **CIM**

Courtesy of Riversdale Resources



The Grassy Mountain project was projected to produce 4.5 million tonnes of coal per year.

Grassy Mountain coal project cancelled by federal government

On Aug. 6 the federal government issued a decision to prevent Benga Mining Limited’s Grassy Mountain coal project from continuing due to its likelihood of causing significant adverse environmental effects.

After careful deliberation and review of available and relevant information – which includes a June 17 report from the Joint Review Panel (JRP) of the Alberta Energy Regulator that also denied the project – the Minister of Environment and Climate Change, Jonathan Wilkinson, concluded the potential environmental impacts of the proposed steelmaking-coal mine in Crowsnest Pass, Alberta are not justified in the circumstances. “The Government of Canada must make decisions based on the best available scientific evidence while balancing economic and environmental considerations,” Wilkinson said.

The Grassy Mountain coal decision statement, which was issued under the auspices of the *Canadian Environmental Assessment Act, 2012*, concluded that allowing the mining project to likely “cause significant harm” to surface-water quality due to selenium effluent discharge; species like the Westslope Cutthroat Trout and the Whitebark Pine (which are already listed as endangered under the *Species at Risk Act*); and the physical and cultural heritage of the Kainai, Piikani and Siksika First Nations.

In response to the decision, Benga CEO John Wallington said that it was beyond comprehension that the minister’s action was taken without consultation with First Nations, with the company or with other communities impacted. The Stoney Nakoda Nation and the Piikani Nation both supported the project.

The government, however, reported that it engaged in consultation with Indigenous communities throughout the environmental assessment. In total, the Impact Assessment Agency of Canada

SNC-Lavalin welcomes **Tony Lipiec** as global vice-president of minerals & metallurgical processing. With 35 years of experience, Lipiec will lead mining and metallurgy process projects at SNC-Lavalin.

Arnab De will be the new chief financial officer replacing **Patsie Ducharme**, who has stepped down at Canadian Metals. Formerly, De was the CFO at Tata Steel Minerals Canada, where he gained \$1.3 billion in funding as he oversaw the DSO project.

Osisko Development appointed **Martin Ménard** as vice-president, engineering and construction. Ménard has been involved in the development of major gold mining projects in Canada and overseas in various engineering and management roles on energy, mining and mineral processing.

Mike McCann joins Iron Ore Company of Canada as president and chief executive officer, taking over for interim president **Donald Tremblay**. He will also take over the role of chairperson of the board of directors of IOC. McCann is a seasoned professional with 30 years of experience in the mining and processing industry.

Lundin Mining announces **Peter Rockandel** as its new president and CEO, as **Marie Inkster** will be stepping down at the end of 2021. Some of Inkster’s notable achievements include the acquisition of Eagle Mine in Michigan in 2013, the Candelaria Mining Complex in Chile in 2014 and the Chapada Mine in Brazil in 2019.

Sandvik’s executive vice-president and chief financial officer, **Tomas Eliasson**, has announced he will leave his position at the end of October 2021. During his time at Sandvik, he ensured strong results in different divisions and delivered stable margins.

Champion Iron has appointed **Angela Kourouklis** as senior vice-president, human resources, and **Michael Marcotte** as senior vice-president, corporate development and capital markets. Kourouklis has 20 years of relevant experience in human resources management, formerly serving as vice-president, human capital management, for La Presse. Marcotte has been working in capital markets for the past 20 years, 15 of those focused on Canadian resource equities.

said that 14 groups participated in the process, and they were allocated funding of \$714,704 to support their participation in the various steps of the review.

Wallington's primary reason for objecting to the federal government decision, however, is focused on the JRP. On June 19 Benga filed an application for permission to appeal the JRP's decision to the Court of Appeal of Alberta, with the company saying that the decision by the panel displays errors of law and procedural fairness that warrant the granting of permis-

sion to appeal. Following the JRP report, members of the Stoney Nakoda First Nation and the Piikani Nation similarly filed requests with the Alberta Court of Appeal to appeal the decision that blocks the development of the project.

According Wallington, Minister Wilkinson's decision to deny the project before the appeal could be heard in court was a "precipitous step."

"By ignoring Benga's legitimate request that he hold his decision in abeyance whilst the legal appeal process

runs its course, the minister has ridden roughshod over the legal rights of Benga, Piikani Nation and Stoney Nakoda Nations, adversely affected economic interests, and relied on a JRP report that is the subject of multiple legal challenges," Wallington said in a statement.

The proposed steelmaking-coal mine in Crowsnest Pass, Alberta, was projected to produce around 4.5 million tonnes of processed coal per year, over a mine life of about 25 years.

— Angelica Zagorski

The pursuit of autonomous mining

Using short-term underground mine scheduling for autonomous fleets can bring efficiency benefits

By Angelica Zagorski

Autonomous mining is trending across the industry, but there are still obstacles to its implementation. Among these roadblocks are mine scheduling processes, which put simply, tell mining vehicles where to go and when. Scheduling is still mostly done manually, but with the possibility of automating scheduling, workers could be moved above ground from dangerous underground environments.

In a new study titled, "Short-term Underground Mine Scheduling: An Industrial Application of Constraint Programming," Max Astrand, R&D lead engineer at Switzerland-based technology corporation ABB, explained how automating the short-term mine scheduling process can increase efficiency in a vital part of the underground mine planning chain.

Short-term scheduling plans make up the basis for operational mine production and operation schedules. Not only does this planning make long-term mine plans more feasible, but it also ensures a steady flow of products allowing companies to meet production targets.

At the same time, however, they are also becoming a bottleneck in the planning chain. Modern mines are moving to automated equipment and semi-autonomous machines, and scheduling what a machine does, when it does it and where it does it, is still done by humans. Scheduling is a human activity thus, it is prone to human errors as well, not to mention its time-consuming nature.



Courtesy of Sandvik

Using constraint programming can lead to higher efficiencies in scheduling autonomous vehicle fleets at mine sites.

Astrand's research moves towards fully automating the scheduling process to a solution with minimal risk or error.

"By automating this, you can react faster to process disturbances like task delays and machine breakdowns," Astrand said.

Astrand's research presents a mine scheduling algorithm that draws inspiration from artificial intelligence, operations research and computer science to develop a method called "constraint programming." This method is not new to industrial processes, as it is frequently used in other industries.

In simple terms, constraint programming is when you specify a problem through the constraints it needs to satisfy. An algorithm using constraint programming will use the constraints given to reduce the possible values of the decision it needs to make, reducing the number of actions it can take. The deductions made from the first decision then propagate to further decision variables until a solution is found that satisfies all the constraints.

Constraint programming has become an important technology for solving hard combinatorial problems in a

diverse range of application domains. Astrand gave the example of using constraint programming to automate the gate allocation at the Hong Kong airport. This type of programming is also used to create plans for one of the world's largest container shipment hubs in Singapore and creates the daily timetable for the public railway system in the Netherlands. Needless to say, the method is not new and is thoroughly tested and used in everyday life.

"With these methods, you can not only construct schedules fast, but you can make better schedules by making good use of the available resources," Astrand said.

By using constraint programming a company can automate the schedule construction, answering the when, what and where of hundreds of activities in a couple of seconds, without introducing resource conflicts. This kind of task would normally take hours done manually. According to Astrand, this programming can improve mine productivity by up to 12 per cent while ensuring safe operations. "In an industry where throughput is everything, and every percentage counts, this presents a major opportunity to sustain mine operations as costs increase."

Using an autonomous short-term scheduler has its benefits and saves a company time and money, said Astrand. "You can make the scheduler emphasize higher-level decision making, adjust to monthly plan compliance and these kinds of things, rather than spending the entire day putting out fires."

Things go wrong quite often in mining, and manual scheduling simply leaves room for more error with conservative schedules. "To avoid ending up in situations where you need to reschedule, you introduce this kind of artificial buffer in your schedule. And these buffers, when they are not exploited, are like missed opportunities for production," Astrand said. "By automating this, you can react faster to process disturbances like task delays and machine breakdowns."

Through using well-functioning scheduling algorithms, miners are getting closer and closer to operating fully automated mines. Dangerous underground environments could be a notion of the past if the pursuit of the autonomous mine continues.

"The actual short-term scheduling problem becomes more complex as you go deeper and it makes it harder for manual schedulers, that currently are on the edge of what they can handle, to cope going into the future," Astrand said. "I foresee that this becomes increasingly important as mines go deeper." **CIM**

Public data promotes mineral exploration in B.C.'s Golden Triangle

The Golden Triangle is the busiest area in terms of mineral exploration in British Columbia. On Sept. 1, in an effort to bring together high-quality data for the Golden Triangle region, Geoscience BC and the mineral exploration and development sector have created a valuable new public data compilation to support economic development and guide decisions about exploration for critical minerals.

The data is meant to improve the understanding of the area's major geological features and the mineral systems throughout the region. The Golden Triangle Geophysics Data



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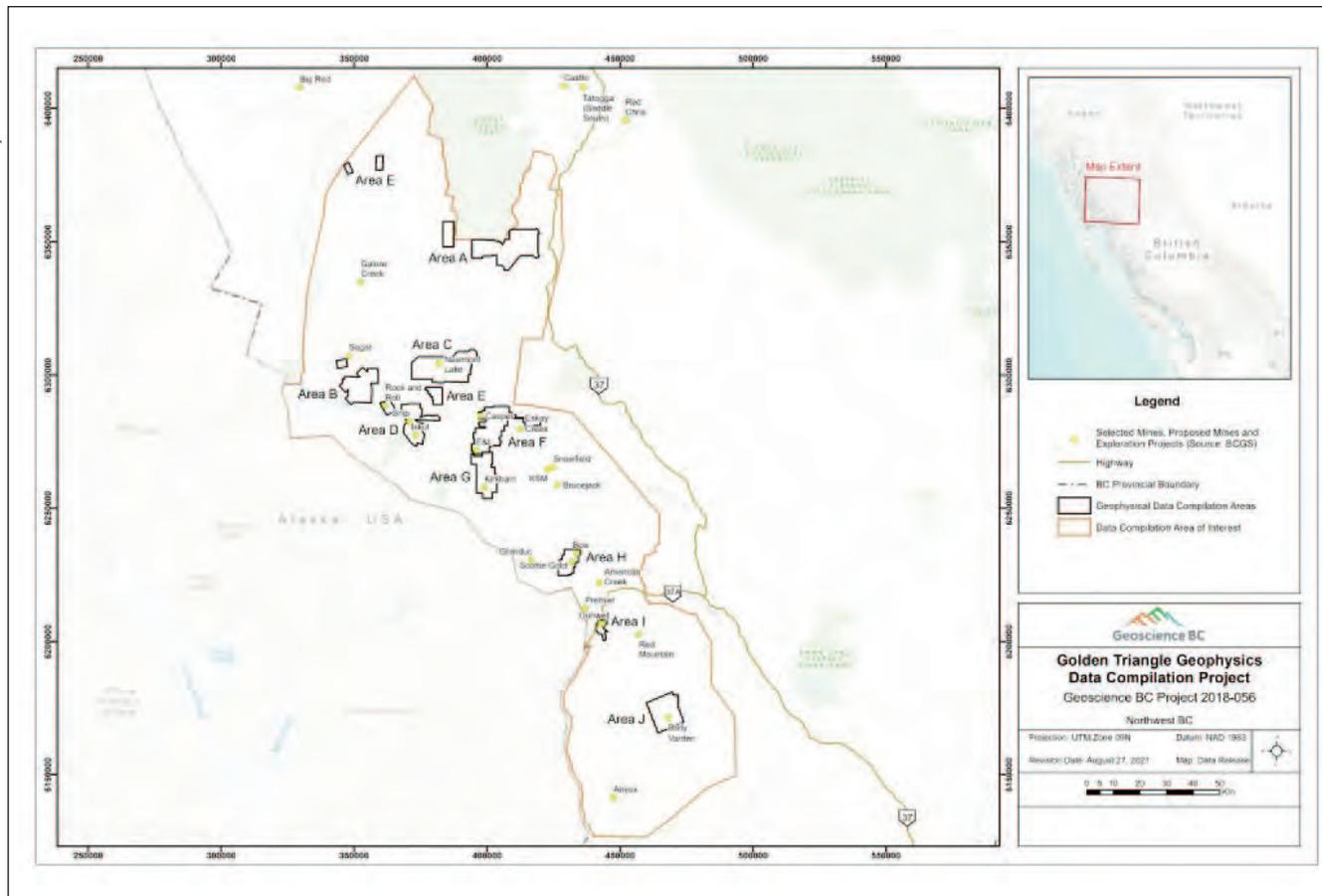


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The publicly available dataset is comprised of 26 survey blocks provided by 10 companies.

Compilation Project covers 1,329 square kilometres of geophysical land data from 10 different companies that was reviewed, purchased and consolidated into newly published public data sets. The main goal of the project was to publish previously private airborne geophysical data sets in the Golden Triangle area and highlight existing public geoscience data.

According to Richard Truman, director of external relations at Geoscience BC, “The thinking behind this was if we can purchase as much data as we can and make them public it will hopefully drive new mineral exploration, but it will also help us to identify whether there are any gaps in the data that already exist that may help make decisions about what future research is needed.”

Truman said it’s highly unlikely that a single company is able to go out and create data at this kind of scale, so now they have the opportunity to take these data and use it to focus their own mineral exploration.

Indigenous consultation was also paramount in the project’s success, as

local Indigenous groups provided input on the area of interest for the project.

“I think one of the things that we hear from First Nations is that it’s helpful for them to know when we’re publishing data, because it’s likely to drive human exploration interest, and they’re likely to see more minerals claims being made on their territory or in their land,” said Truman.

Ultimately, the data are meant to encourage the mining sector’s activities in the region. “We hope it will bring some new investment and some renewed interest to the area,” said Truman.

– Angelica Zagorski

ArcelorMittal receives \$400 million federal investment for clean steel production

Continuing in its recent commitments towards sustainable metal production, on July 30 the Canadian government announced a \$400 million investment in ArcelorMittal Dofasco to support the

phase out of its coal-fired steelmaking facilities in Hamilton, Ontario.

The project, which will cost \$1.76 billion in total, will convert ArcelorMittal’s current steelmaking facilities to a hydrogen-ready, direct reduced iron-fed electric-arc furnace. According to the announcement, this will be the first time that this technology will be used at this scale and is expected to reduce greenhouse gas (GHG) emissions by three million tonnes per year by 2030.

“The plans we have announced today represent a historic moment for ArcelorMittal in Canada and North America, making the beginning of a new era of steelmaking in Hamilton that will result in a 60 per cent drop in CO2 emissions within the next seven years,” ArcelorMittal CEO Aditya Mittal said. “We are very pleased to be in partnership with the Government of Canada. As partners, we all recognize that it is vital to accelerate our reduction of carbon emissions and strengthen our climate action. Indeed, progress in the next decade is vital if the world is to reach net zero by 2050.”

Courtesy of ArcelorMittal



The project is expected to remove yearly greenhouse gas emissions equivalent to 1,800,000 cars.

Canada’s investment will come from the Strategic Innovation Fund’s Net Zero Accelerator Initiative, which will invest \$8 billion over seven years towards decarbonizing large GHG emitters in industries across the coun-

try. Previously, on July 5, the government announced a similar investment of \$420 million in Algoma Steel’s facilities in Sault Ste. Marie, Ontario, to support the company’s transition to electric-arc furnaces.

The two projects combined, according to the announcement, will represent GHG savings of six million tonnes per year, equivalent to taking 1,800,000 cars off the road, or as many cars as there are in Montreal, Toronto and Vancouver combined. ArcelorMittal’s project is also expected to support up to 2,500 construction jobs through subcontracting.

“We are supporting our steelworkers and companies like ArcelorMittal Dofasco as they seize today’s opportunities in the low-carbon economy and they do their part in the fight against climate change,” said François-Philippe Champagne, minister of innovation, science and industry. “This investment will ensure that Canada’s largest producer of flat-rolled steel adopts innovative technologies, continues to provide economic opportunities for Canadian workers and contributes meaningfully toward our climate targets. This investment will create good jobs in communities like Hamilton and lead to clean Canadian-made products in the world for decades to come.”

– Matthew Parizot

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Getting out what you put in

A large part of mentorship is doing the work needed to be a successful mentee

By Tijana Mitrovic

For students and recent graduates hoping to build their network, mentors and mentorship programs can act as a bridge to making connections and gaining insight into the industry. That is, if the students put in the effort to find, build and guide the relationship.

Since the CIM mentorship program launched in January 2020, it has been matching CIM student members with industry professionals, giving the students access to somebody to speak with, ask questions of, receive feedback from, turn to for guidance and receive encouragement from as they enter the mining industry. “What we offer is the opportunity to get to know other folks, feel comfortable and get acquainted with people,” explained Tenisha Valliant, membership development strategist at CIM.

Having mentors who talk about their own experiences and share insights into the various aspects of the mining industry they have been involved in also increases students’ exposure to different career paths and opportunities, especially if the mentors engage the students in discussions about their career goals and help build confidence as they develop their skills. “It all depends on what [the students are] looking for, on what they need,” said Valliant. “Is it guidance, is it to feel comfortable, is it to feel welcomed, or is it to get a connection to landing their first job? Whatever it is, the program can be useful.”

Of course, not all mentorships come about through formal arrangements. Some originate organically or are the efforts of one individual seeking out a more experienced colleague directly. Regardless of whether a mentee is in a program or acting independently, it is up to the mentee to set the relationship up for success. Identifying the skills and knowledge they want to develop or gain and working with their mentor to seek out learning resources can set the tone of the working relationship. Mentees can also prepare a list of career goals and objectives to share with the mentor, create a similar list of goals and objectives for the mentoring relationship, pro-actively request feedback and listen to the mentor’s comments carefully.

“What we hope that mentees understand is that they are leading this process,” explained Valliant. “Therefore [they] need to know what they want out of it, where they want to be and what are their goals. If they know exactly what they’re hoping to achieve in the next one to five years, then when they meet with their mentor and talk to them, they know what kind of questions to ask.”

The formal route

For those seeking out mentorship programs, national organizations such as CIM and the Society for Mining, Metallurgy & Exploration (SME), as well as regional organizations such as Women in Mining and Women in Nuclear Saskatchewan (WIM/WiN-SK), can be a good place to look. Students can also check to see if their mining program or university offers a mentorship program, such as the University of Alberta’s Female Engineering Mentorship program or the University of Saskatchewan’s MentorSTEP program, which is geared towards Indigenous women in high school and university.

For Jocelyn Peltier-Huntley, vice-chair of WIM/WiN-SK, mentorship is important for students and new graduates because it helps them build their network. “It gives women a chance to get some career advice and empowers them and maybe helps them gain confidence in different areas and skills that they want to work on, where they’re learning from a mentor who has those skills,” she said.

The WIM/WiN-SK mentorship program gives women in the Saskatchewan mining or nuclear sector a chance to connect with leaders in their field and develop leadership skills. Originally founded in 2017 as a pilot program, it relaunched this past March with a six-month cohort of 60 anticipated mentee-mentor pairs. Mentees are not limited strictly to people who are already employed. Students in school and recent graduates looking for their first jobs are also eligible to participate.

A mentoring program lays the foundation for a mentor-mentee relationship, but those relationships are not beholden to

Wondering what to do with your mentor? Check out these ideas:

JOB SEARCH PREP

- Mock interview
- Do an informational interview
- Look at job websites together
- Review your CV and cover letter

GOAL SETTING

- Establish goals for your mentorship
- Discuss career interests and accomplishments
- Review your career goals together

LEARN MORE ABOUT THEM

- Tour their workplace
- Ask about their work life
- Ask about their own mentee experience
- Learn how your mentor found their job

an official timeline. “We’ve heard quite a bit from people who were in the two-year pilot program [that] they still keep in contact with their mentee or mentor,” said Peltier-Huntley. “Some people [who went] through that two-year program, they ended up starting off as a mentee and then came back later as a mentor.”

When applying for mentorship programs, Valliant suggested that prospective mentees clearly demonstrate why they are interested in having a mentor. “What we look for are those who understand the value of building relationships and who are eager to forge those relationships and learn from the people that they meet,” she said.

As part of the application process, Peltier-Huntley also encouraged students to investigate if there is any financial support offered by the mentorship programs. “When we’re putting together programs like this, we’re thinking about people who are primarily already [working] in the industry, [but] we do have a bursary program to support students and those who might be in financial need,” she said. “Don’t be afraid to apply [for financial aid] because sometimes when we had students apply for the program and then we [realized] they were students, we would [suggest they apply for a bursary] to make sure that [they are] not financially burdened and are able to participate in the program.”

The do-it-yourself approach

Established programs are not the only way to find mentors: students and recent graduates can also seek them out and establish relationships on their own. In starting this process, it can be a good idea to brainstorm with managers or coworkers from previous jobs, internships or volunteer placements. Does anyone stand out as a potential mentor? Does anyone have a career path that the mentee wants to follow? LinkedIn, alumni networks, or recommendations from friends and colleagues can also be good ways to find potential mentors.

Students and graduates should also consider what mentorship style would best suit their needs. Is it a guide, who can help develop professional connections and insight into the industry, an advocate, who can act as a cheerleader and create opportunities for further networking and job leads, or a coach, who can provide feedback?

When approaching someone about a mentorship relationship, communicating clear goals and expectations is key. That, as well as expressing enthusiasm for professional growth and admiration of the prospective mentor and their work, can demonstrate to the potential mentor that the mentee is serious and committed. If the mentor seems interested after speaking, the would-be mentee should follow up.

Keep in mind, a mentorship is a time commitment for both the mentee and the mentor. Mentees should not only make the most of their meeting times, but be prepared to put in the work to make the relationship flourish. If done properly, they can secure industry guidance and advice, new skills and even a lifelong connection. **CIM**

NEXT STEPS

Throughout 2021, our Next Steps series will cover topics focused on early career and professional development to help mining students and recent graduates build their future. If you have any suggestions, reach out to us at editor@cim.org.

LEADERSHIP INTERVIEW: MICHELLE CAREY

Michelle Carey is chief of product management and marketing at IMDEX, a mining technology company based in Australia.

CIM: What do you want prospective mining students and new graduates to know about the industry?

Carey: It’s not one size fits all. Just as not all mining jobs are fly-in fly-out, not all mining jobs are mine-site jobs. The employment diversity is extensive. There are a range of careers in an array of companies, including data startups such as Datarock and GoldSpot Discoveries, engineering firms such as Hatch, OEMs such as Sandvik and Orica, and software companies such as Maptek. Consultants such as Deloitte have large teams dedicated to mining, and then there are boutique companies specializing in sustainability.

CIM: Why do you feel that mentorships are helpful for mining students and recent graduates?

Carey: Having a mentor enables mining students and recent graduates to learn from the lived experience of senior professionals who have significant industry knowledge and, importantly, have already made mistakes and learned from them. Through that knowledge sharing, the students can be reassured what is normal, what isn’t, and what good looks like in their chosen field. It also introduces them as early as possible to networking, which is a valuable and necessary skill.

CIM: What are some of the emerging skills in the mining industry that you believe students and new graduates should develop?

Carey: The hard skills are the obvious things around digital technologies and automation. The soft skills are always what really matter; the ability to adapt to change and to work in a collaborative manner are front and centre for me when I am looking for people to join our organization.

CIM: Similarly, what are some things that students can do while in school to help their careers and professional development?

Carey: Get exposure to different parts of the industry. In general, be inquisitive, get involved, try new things, experiment and ask questions.

CIM: Do you have any general advice for mining students looking to start their careers, in terms of job applications, standing out, or anything else?

Carey: Finish your degree. In boom times companies will get desperate and start taking undergraduates from second and third year. It can be incredibly tempting to take up a job offer, and while there are success stories, for most people it’s worth sticking it out and getting the degree. We work for 30 years or more, there is time.



Direct drives on electric loaders, like this Sandvik LH518B, give operators precise control of their vehicles.

Loading up on improvements

Combining electrification and automation can lead to operating efficiencies

By Robert Hiltz

More than just environmental efficiency, electrification brings precision to mining operations far and above what is possible with diesel equipment.

This means that when electrifying parts of a mining fleet, you can create all sorts of benefits for your operation down the line. The advantages become particularly evident once loading and drilling activities are automated.

David Hallett, vice-president of automation at Sandvik, explained that the precision advantage of electric equipment will help his company solve some difficult automation problems.

“Loading, in particular, autonomously has been a tough nut to crack over the years,” Hallett said. “We are able to engage the loader in a much more effective way utilizing electric drives, rather than traditional mechanical drives, so that our fill factor is realized. And we’re also able to control the wheel spin in a much more efficient way.”

Unlike their internal combustion engine (ICE) counterparts, electric vehicles typically use direct-drive technology. This means rather than connecting the motor to the moving parts of the vehicle through a transmission (with its assortment of gears and clutches), the motor is essentially connected directly to the wheels. This results in less loss of power from the motor to the wheels than experienced by ICE equipment, and at the same time, provides more precise control over the vehicle.

Typically, when loading from a muck pile – whether there is a driver in the cab, an operator running the loader remotely, or an autonomous system in command – driving a diesel loader into the pile requires a certain amount of finesse and judgement to accurately place the bucket into the rock and fill it to capacity. Diesel-driven equipment has a lag time from when the throttle is applied to when the power makes its way to the wheels, and this can result in too much or not enough power being used at the exact moment it is needed. Too much power and the wheels spin, causing damage to their rubber; too little

power and the loader needs to take a second run into the pile to come away full.

Electric drive solves this by reducing the lag time and delivering more precise control of how quickly the vehicle encounters the pile and where exactly the loader meets the rock.

Brian Huff, vice-president of technology for battery and hybrid electric vehicles at Sandvik, said the control comes from the accuracy and speed of data that is available from an electric piece of equipment.

“Because we have very direct and accurate feedback on motor torque, we can translate that directly to tractive effort,” he said. Tractive effort is the force exerted by powered equipment and is measured at the rim of the driving wheels.

“We know exactly how hard we’re pushing into the muck pile. That feedback variable was really difficult to obtain with a torque converter on a diesel engine,” said Huff. “You don’t know how much of that power is actually getting to the wheels.”

According to Huff, the telematics data generated by a BEV is one of the enabling factors to more precisely control and automate the handling of a vehicle.

“Where you had less feedback before [from ICE vehicles], now you’ve got so much information that it’s accelerating the improvements in the loading cycle,” he said. “We can vary torque about 5,000 times per second, so we have really, really tight control over power and speed. It’s not just the speed feedback, we know the position of the rotor at every instant. It’s that refined, and it’s inherent in the driveline technology that we’re implementing. That translates to controllability.”

Drilling is another function where an electric drive’s controllability makes a compelling case for its use, according to Johannes Väliavaara, Sandvik’s global product line manager for mining and tunnelling.

“The customer would first drill a full fan and then move the unit two or three metres backwards, continuing to drill the next



Courtesy of Sandvik



If needed, electric drills like this Sandvik DD422iE, can divert power from their onboard batteries to balance the demands of drilling.

[fan],” Väliivaara said. “Electrification, by its nature, provides much better precision on how you actually position the unit, because now we have a direct mechanical connection from the electric motor to the drive line versus a conventional solution, where you might have a diesel engine, the torque converter and the gearbox.”

“That electrified solution brings much better accuracy in drilling, particularly when you are looking to position your equipment at the right location from where the drilling would continue,” he said.

A battery-powered drill also offers a side benefit, in that the onboard battery can make up for drops in power availability to the mine’s infrastructure during high-load times or when faced with other limitations.

“We can draw the reserve power from the batteries to balance the drilling itself. Being able to adapt in conditions where there are limitations – for example, how much power you can pull through the electrical infrastructure – actually represents a possibility to boost your drilling productivity,” Väliivaara said.

Of course, automation is still possible with diesel equipment. But getting close to the same levels of precision that are achievable with electric vehicles requires adding sensors to ICE equipment, often on the outside of the parts in question, putting them in vulnerable areas.

“Those are often add-ons that are external sensors outside of the gearbox, or the axle, which are susceptible to wear and tear and damage in mining environments,” Hallett said.

For companies building new mines, considering both electrification and automation means that the new facilities can be designed with productivity maximization in mind, and with a lower price tag.

“Using battery electric vehicles, together with automated systems, [mean] you can also then reduce the development of the [mine footprint] size required for your equipment, which would then reduce the overall total investment that would need to be done for an extraction level,” Hallett said.

He explained that, essentially, without needing to make room for people to walk or ride in a machine, and without the need to provide sufficient ventilation so that large numbers of people can breathe underground and so that diesel engine exhaust can be eliminated while the engines themselves can obtain enough air intake to operate, mine drifts could be much smaller and cheaper to operate.

Whether they are building new mines or retrofitting existing ones. Sandvik’s customers are thinking about automation and electrification at the same time.

“I can see, almost invariably, every customer for battery equipment wants to know if it’s automated,” Huff said. “If they’re at that level where they’re looking at technology advancements and they’re looking for optimizing their operation, they’re looking for both. It definitely is not an either or, it is always both.”

That, however, is not the case for every OEM. Patrick Marshall, the vice-president of product management at MacLean, said that while many of his customers are looking for automation or electric vehicles, these efforts can be siloed within the mining companies.

“Often, the team evaluating electric vehicles for the mine site is different from the team trying to get automation into the mine site,” Marshall said. “This can result in overlooking the combined benefits.”

He can, however, see the day when the two converge. “They’re closing the gap for sure where people will talk about how the two work together much more frequently,” he said.

As to why some customers are currently looking to do both at once, a large part of the explanation may be generational. Joshua Marshall (unrelated to Patrick Marshall), an engineering professor in the mining department at Queen’s University who focuses on automation, said some of the reason for these mines picking both comes down to demographics.

“The people who are becoming the managers at mines are now the people who grew up with video games and the Internet and have that kind of technology mindset,” he said. “They’re asking, ‘Why are we not doing this with robots, and why are things not electric?’”

Those questions are even being asked about the tasks that were previously considered impossible to automate, such as changing the bits on a drill, plugging in a machine or filling a fuel tank. And mining equipment companies are trying to answer them. Sandvik, for example, has created an AutoSwap system that allows for quick battery changes without the operator leaving the cab. The whole process, from powering up a secondary battery source (so the machine can perform the battery swap without its existing battery), to disconnecting the current battery’s high- and low-voltage connections, to dropping off and picking up a new battery is automated at the push of a button. All the operator needs to do is position the equipment next to the fresh battery after the used one is dropped to the ground.

“You could deliver a battery to the machine if you wanted to. You don’t have to have a [maintenance] location to take it to,” Huff said. “There’s lots and lots of flexibility inherent to the design, it doesn’t need to be flat ground, it doesn’t need to be a prepared surface really in any way. You can swap anywhere.”

“That’s going to directly lead to automating the swapping practice going forward,” Huff said.

Down the road, the only underground human intervention to the process might be simply to plug in the dropped-off used batteries into the charging units and return to the surface.

“Somebody just has to come in, unplug one battery, plug in the other battery and then leave. It’s not a continuous labour need, it’s about every four to five hours,” Huff said. And it will be just one further step on the road to fully automated mines, or at least as fully automated as possible. **CIM**



Five critical requirements for capital project success

By Ian Pearce

Four out of five greenfield mining projects are either late and/or over budget by more than 40 per cent. Rates of return are usually in the single digits. In my experience, mining companies must fulfill five essential requirements if they want to improve the likelihood of delivering a successful project.

1. Build a proven team

This is the single most important factor. The right team, which includes members who have a proven track record in defining and executing projects, is critical. Experience in conducting studies is not enough. This point goes for all phases of defining and delivery of the project.

2. Define the project

Successful projects use defined gates that delineate the work and deliverables for each of the phases. Each gate includes a formal review process to determine the status of the project; advance the project; revise the scope of the project; or end the project.

Projects go through five phases: definition, execution, commissioning, production and closure. The definition, execution and commissioning phases relate to getting the project up and running. Operations are defined by production and closure phases.

At the definition, execution and commissioning phases, six essential questions must be answered:

- **Why?** The answer to this question is the business case.
- **Where?** This answer leads to an understanding of location and impacts.
- **What?** This answer provides the scope of facilities.
- **How?** The answer to this helps to define the services (work) required to place the facilities so that operations can begin.
- **Who?** This response identifies all the parties involved.
- **When?** The answer to this clarifies the timelines and the relationship between the activities.

The completion of the feasibility phase is what gives a project the clarity to arrange finances, but in no way is it a trigger that defines the project as “execution ready.” The feasibility document contains time-sensitive market information, so there should not be a gap of more than six months between the feasibility study and execution.

What is still required, beyond the feasibility document, are plans detailing the work and the deliverables for the execution phase. The work to create the deliverables list involves providing extra detail around what, how, by whom, and when.

The deliverables are then supported by a critical path analysis (CPA) of the master schedule. Think of the CPA as the foundation of the schedule of work. It is also the basis upon which to do all resource planning. The CPA lays out which tasks must be completed on time for the project to come in on schedule. It also

identifies which tasks may offer schedule flexibility, reflected as excess float in the schedule.

This attention to detail in the definition phase will help projects manage risks and seize future opportunities. Remember that one needs to spend at least 10 per cent of the total installed cost of a project to get it to the “execution-ready” stage. So, on a billion-dollar project, one needs to spend at least \$100 million in defining that project. Skimping on the definition, just sets a project up for problems and possible failure.

3. Establish the tools required to manage, control and report on the project

Each work stream or function requires customized tools that can be used to forecast and manage scope in a timely and integrated way. Tracking engineering, procurement, deliveries, quality, contracts, schedule, costs and risk can be done using existing planning and scheduling tools available in the open market.

It is a common mistake to take operational practices and procedures and try to modify them for use on a project. Projects should not be run on annual operating budgets; they require their own cost accounting processes and financial accounting practices – ones that will differ from those typically used in operations. Having project cost accounting usually means having a separate accounting system, frequently generated reports, specialized forecasting and tracking procedures (often tied to KPIs).

4. Understand the drivers to productivity through all stages of a project

The main activities of any project are typically, engineering, procurement and contract formation, delivery of materials and equipment, contract execution and the installation of all the equipment and materials. This culminates in the commissioning and handover of the project to the operations team. Each of these areas of activity needs to be understood and to have related productivity drivers (value driver trees) established and managed, as efficiency is the main tool available to projects to deliver on time and budget.

For example, deciding when to mobilize the field activities has a huge influence on productivity. Field mobilization, which can include bringing in heavy machinery and drilling equipment and beginning camp construction, occurs when engineering and associated activities are around 30 to 60 per cent complete. At that point, the company has a clear understanding and has made a commitment around basic aspects of the project but can still incorporate some flexibility to account for unforeseen situations.

Keep in mind that earthworks are not the same as mining. While both can make use of heavy machinery to dig and move

earth, it is not recommended to mobilize mining fleets early for this purpose. This results in equipment damage and/or poor productivity. Employ specialized earthworks fleets to prepare the site and the ground. Save the mining fleet for mining. Efficient execution advances the schedule, resulting in lower costs.

5. Transition from bulk construction through systems completion and commissioning to ramp up

Commissioning and ramp up of projects need a different approach to that of steady-state operations. Contracts must set out the terms for management of construction teams. Assembly of most of the equipment from vendors' shops and fabricators occurs on-site. These activities require a proper commissioning phase with planned and discrete deliverables, which are outlined as early as possible, preferably when you are defining the detailed execution plan. Lack of planning can lead to equipment damages, in long downtimes and claims for extra work from contractors. Modifications, without a full understanding, can lead to not achieving nameplate capacities.

Unfortunately, there are no silver bullets to project planning. Success lies in doing work up-front and relying on the judgement of a knowledgeable and experienced team. **CIM**

Ian Pearce serves as advisor and non-executive director to both public and private companies in the energy, mining and metals sectors. This column is an edited version of his keynote address at the Capital Projects Symposium 2020, which is available to view at academy.cim.org.

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Great Panther Mining runs a Safety Olympics competition at its Brazilian operation. Every two months, the winning team is presented with the Gold Hat trophy and at the end of the year, the overall winners receive \$100,000 Brazilian Reals (\$17,500) in safety-initiative funding, to be spent at the team's discretion.

Putting safety into practice

Culture gaps and complacency are contributors to mining safety issues

By Rosalind Stefanac

Now, more than ever before, mining companies across the board are striving to improve safety protocols with the ultimate goal of zero-lost-time injuries and zero fatalities. To that end, mining companies have invested in additional safety training and risk-management assessments while adopting safety performance measures that reward achievements and aim to standardize best practices.

Yet, despite major reductions in injury-frequency rates and a steady decrease in mining fatalities over the decades, tragic incidences at Canadian mining companies continue to take the lives of miners every year. (In 2019, 20 people working in the Canadian mining industry died on the job, while 39 people lost their lives in 2018, according to data supplied by the Association of Workers' Compensation Boards of Canada.) That is not surprising, when, according to one safety expert, Canada's safety performance is still average at best on a global scale.

Corrie Pitzer, CEO of Vancouver-based Safemap International, a specialist in safety transformation and strategic safety management who consults with mining companies in Canada and around the world, formed that conclusion, based on his experiences in the industry and his interactions with mining companies. Additionally, he feels that for all those Canadian companies stepping up to improve their health and safety performance indicators and who already are well ahead of many mining companies in approach and practices, there are others who are still as much as 10 years behind where they should be.

"In some areas of mining, the thought is if you have the controls in place and people comply to them, you should be fine, but it's much more complicated than that," he said. "A lot of catastrophic events still happen when people comply. It's the readiness of people to respond to risk and the focus on risk that differentiates some Canadian organizations from the much more advanced ones."

Mike Parent, vice-president of prevention services at Workplace Safety North (WSN), and a former underground miner himself, said it took him years to really appreciate the number of risks underground workers are exposed to daily – even with a supportive organization and a thorough workplace orientation. "There are hazards such as falling rock and equipment that can crush you, or the things that you don't see that are poisoning you," he said. "Or other major risks growing in a part of a mine that no one is aware of." This could be underground water accumulation that could result in a run of muck that would crush everything in its path, for example.

To identify the top risks in underground mining and determine the root causes and controls needed to prevent future accidents, the Ontario government – in collaboration with the Ontario mining industry – initiated an extensive review in 2014 that Parent said is helping steer Canada in the right direction. The final report identified six key areas – health and safety hazards; new technologies; emergency preparedness and mine rescue; training and labour supply issues; and

internal responsibility systems (IRS) – and provided 18 recommendations being implemented by government and other industry stakeholders to reduce occupational risks. The Ontario Ministry of Labour also completed a surface-mining sector risk assessment workshop in 2016 and released a summary of the findings.

“We’re better off to be pre-emptive in understanding where the potential failures can be and what probable controls should be in place before we have a number of incidents to study from,” said Parent. “Ongoing, the focus needs to be on the top risks and making sure effective controls are actually in place to protect [workers].” Number one among the risks identified in the underground mine risk assessment is ground control (rock bursts, rock falling underground) followed by mobile equipment involving large or small vehicles and pedestrians.

Culture is crucial in reducing safety risks

Parent said another issue preventing Canada’s mining sector from faring better on the safety scale is a disconnect in company culture. In conducting a pilot study of an IRS audit tool – a concept that grew out of the initial 2014 review – in six mines in Ontario, he and his team discovered that the worst-performing mines in application safety had the biggest gap in perception between workers and leadership in terms of what was working and what was not. “What we’ve come to understand is that the workforce likes to be involved and they want to see a leadership that’s actually present to really understand what’s going on in the operation,” he said. “In my experience, I’ve found that when leadership truly has its finger on the pulse, they can better address the realities of the workplace – these were by far the best-performing operations.”

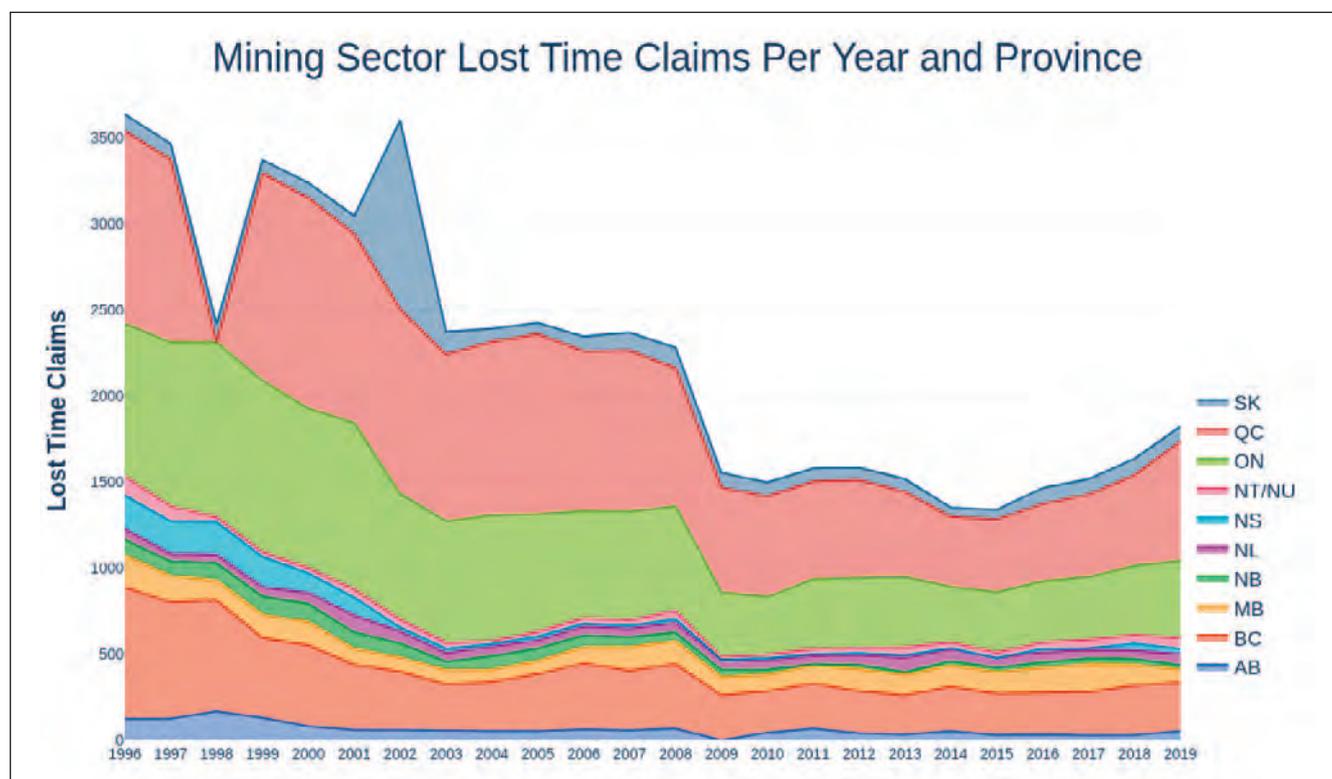
At Great Panther Mining, a gold and silver producer with assets in Mexico, Brazil and Peru, addressing culture issues has

meant not only filling communication gaps between leadership and field workers but also customizing safety messages to fit different workplace cultures in the field. The company’s chief operating officer Fernando Cornejo said that to promote change that will improve safety behaviour, the leadership team needs to understand the cultural idiosyncrasies of the country and adapt the messaging accordingly. “In our case, the Brazilian culture is very different from the Mexican, so getting [workers] to really understand what we’re trying to push in safety will change depending on the country,” he said. For example, in Mexico the goal is to empower employees to speak up if they see conditions they deem unsafe, while in Brazil where employees are more outspoken, the aim is to align that energy towards risk assessment using safety tools.

In 2020, Great Panther launched a safety Olympics program in Brazil (that will be expanded to its other operations), which awards points for the use of safety tools and rewards those groups that score highest. The best-scoring group wins a cash incentive that can be invested in its own workplace and site as the workers see fit. The company also encourages each of its mines to nominate three candidates for its annual Kenneth W. Major Award for Safety Excellence. (Major was director of the company and a safety advocate who passed away in 2018.)

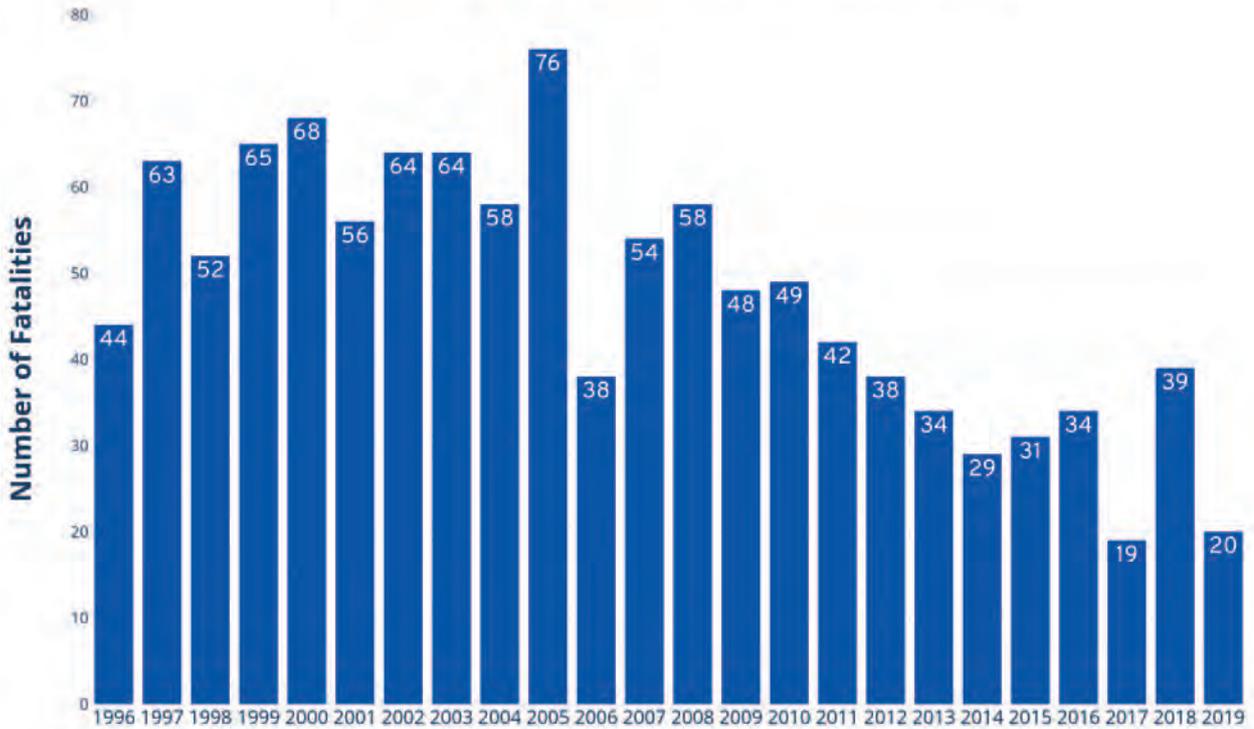
“I think part of the evolution of leaders in the mining industry is to recognize that you cannot punish but [should rather] reward people and provide incentives, so this is something they will want to do,” said Cornejo. “Being recognized has a powerful effect on employees.”

Developing an atmosphere where workers in the field respect each other is another powerful element in building a safety culture. Director of exploration at Treasury Metals, Maura Kolb, has been leading exploration teams for the last 10 years. “If you think about the people you’re working with,



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respect them and watch out for each other, that level of care goes a long way and the internal response system works well,” she said. “We’ve stopped to really think about why we care about safety instead of making it a tick box to check off.”

In her current role, Kolb and her team of 14 have developed strategies that are working well when it comes to allaying mistakes that can lead to injuries in fieldwork currently underway in northwestern Ontario. Planning task flow and conducting daily morning lineups, for example, ensures all team members have a clear idea of what needs to be done every time they go out into the field. “I try to make sure I’m in the morning huddle, too, and in the field on-site checking in,” she said. “Injuries happen when we get busy and sloppy and constant communication really helps us from getting there.”

Finding proactive ways to prevent field risks is always on the company’s radar too. With forest fires this summer happening near exploration sites, her group initiated a meeting with the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry. “We actually had ministry [staff] coming to the site to do a [one-time] review of practices we’ve put in place with our drilling contractors to mitigate the risk of starting a fire in a drill move,” she said.

Kolb explained that getting a new set of eyes into the field every once and a while can be beneficial in spotting potential risks the regular crew is missing. In turn, going to inspect other workplaces herself helps her to recognize if there are risk areas in her own site that the team may have become complacent about.

The ultimate safety atmosphere is about each employee owning their own safety and that of their field partners. “So, it doesn’t have to be the manager that suggests a change, it could be anyone,” she said. “We’re all equal partners on the safety field and that’s the overall culture we should have in our industry.”

Eliminating “risk secrecy”

To make mining safer overall, the industry needs to reduce the focus on performance numbers and eliminate the emphasis on zero-lost-time entirely, believes Pitzer. “You can be at zero and catastrophic events [can still be] only a few seconds away,” he said.

In fact, in working with some of the industry’s leaders whose lost-time-injury rate performance numbers were stellar, he found growing levels of “risk secrecy” working their way into companies’ attitudes about safety. “People become increasingly reluctant to upset the applecart when a company is doing well and this puts extensive pressure on employees, especially those in the front-line,” he said. “We’ve found enormous fatal risks sitting there with people not wanting to talk about them because of apprehension in sending back bad news.”

Instead, by defining “safe” as a readiness to respond to risk, Pitzer said companies can develop a culture that will ultimately protect employees. This means finding the right balance of safety strategies, risk discovery, risk analysis and risk control. As part of that, he said supervisors at the operational level should be trained to “entice and invite people to speak up” about concerns. “The onus is not just to comply to rules, but for employees to understand they have an obligation to stop work that is unsafe for them to do.” 

Mike Parent and Corrie Pitzer were speakers at CIMVTL21. Their presentations (and others from the conference) can be accessed on the CIM Academy website: <https://academy.cim.org>.

To read the Mining Health and Safety Risk Assessments and the Root Cause Analyses that originated from the 2014 review, see the Workplace Safety North website:

<https://www.workplacesafetynorth.ca/industries/mining>.



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The Me Too Mining Association's DIGGER acronym and educational program address what people can when they observe harassment and discrimination occurring.

Digging into discrimination

The Me Too Mining Association is working to make the industry a safer and a more inclusive place for everybody

By Alexandra Lopez-Pacheco

It has been four years since the #metoo movement shattered any delusions that workplace sexual harassment and assault are rare – including in mining operations. It has been three years since Susan Lomas founded the Me Too Mining Association to empower the mining industry with tools to bring about the changes needed to end the problem. But even with the passage of time, sexual assault and harassment have not disappeared from the workplace. The industry, it seems, has not learned the lesson that it should be taking action to keep its workers safe from sexual assault and harassment.

The most recent and public example of the lack of understanding about how serious the situation is originated in Australia, where executives from Rio Tinto, BHP, Woodside, Fortescue Metals Group and Newmont found themselves issuing public apologies for their lack of action.

The statements came on the heels of the announcement of a Western Australia parliamentary inquiry into sexual harassment and assault in the mining sector, which in itself, followed news that police had laid charges of rape against two BHP workers and had investigated other incidents of sexual assault and harassment over a number of years.

During an unprecedented media conference in June, the mining executives collectively apologized to all the victims of the abuse in their industry and pledged to create safer workplaces for women. Paul Everingham, CEO of Western Australia's Chamber of Minerals and Energy, was quoted at the time as saying he previously hadn't been "necessarily thinking that this is the most significant issue on mine sites, but over the last 12 months, you know, I readily admit, I've learned a lot and it's certainly prevalent."

In August, submissions to the Australian government inquiry were made public. According to reporting by Reuters, BHP said that it had fired 48 employees since 2019, following complaints of sexual harassment, allegations of rape and unwanted sexual touching. The company said it found 73 substantiated reports of sexual harassment during the two-year period. In the same article, Rio Tinto said it received one reported case of sexual assault and was able to substantiate accounts of 29 of sexual harassment. It was unable, however, to verify 14 additional claims. Fortescue reported 20 harassment incidents in 2021 and 11 in 2020.

Lomas has known how prevalent the problem is for more than 30 years, in part because of numerous personal experiences as the target of distressing and traumatizing sexual harassment while working as a geologist in mining sites across the globe.

"I've worked in the isolated camps in the North; small and big exploration camps; mines and offices in more than 30 countries," said Lomas. "I've seen a lot of different environments. That kind of exposure helped me realize how many different types of workplace environments there are in mining."

When the #metoo movement broke the silence and denial about sexual harassment and assault in other industries, Lomas took a year off her consulting work to study anti-harassment programs across sectors and identify the most successful approaches to prevention.

In her capacity as president of the Me Too Mining Association, Lomas is often seen as the go-to person to provide commentary on situations like the one in Australia. In fact, she was interviewed by the *Financial Times* on precisely that topic. But more than speaking out after assaults or harassment have been revealed, Lomas believes that steps can and should be taken to prevent the actions in the first place.

It turns out that harassment and discrimination are enabled by the very culture of silence and minimization behind the industry's denial. The solution, Lomas concluded after her research, lies in culture change.

"Discrimination is not always done with malicious intent," said Lomas, who was a presenter at CIMVTL21. "Some people are just uncomfortable and say things that are completely inappropriate."

When discriminatory and degrading attitudes and values are minimized and normalized, victims of the abuse are left feeling alone behind that wall of denial, not knowing who to turn to for help. Bystanders who witness abusive and degrading behaviour often look the other way for a variety of reasons, inadvertently giving perpetrators of the abuse a sense of protection and empowerment.

"Me Too Mining's mandate is culture change and removing the support system that keeps [perpetrators] feeling supported in their behaviours," said Lomas. "The research looks into what stops us from becoming an active bystander and intervening and [shows] that you just need to know what is making you hesitate to help you to overcome it."

DIGGER

Based on that research, Me Too Mining created a customized bystander-intervention program for the mining industry.

The association's four-and-a-half-hour-long DIGGER program provides participants with industry-specific scenarios

and skills training on different types of bystander responses and the role they play in creating either a positive workplace culture or one that is complicit in allowing degrading and abusive behaviour. DIGGER is an acronym that stands for an active bystander's toolkit – Direct action, Indirect action, Get a co-worker, Get an authority, Engage the target, Record and report.

"It's really hard to stand up to harassers when you are the target of the harassment," said Julia Gartley, a senior process engineer, who was a victim of horrific sexual violence in a mining workplace early in her career and who is now director of Me Too Mining. "How powerful would it be if that target does not have to be the one who speaks up? If somebody in a meeting makes a rude comment and someone else says, 'Well, that was rude.' Or when someone hears the jokes or sees inappropriate photos or hears rumours and has the courage to speak up. How much that would change things."

The minor interventions and skills outlined by DIGGER not only help change the culture, they can potentially also help reduce more severe attacks.

"Like anything else, you have to practise," said Gartley. "I'm not saying it's easy, but if you practise these little steps and you ever witness something that is more toxic or extreme, you may have built up the strength to be able to speak up and it might have a much more powerful impact."

Addressing all forms of discrimination

Ross Sherlock, a professor who is the director of Laurentian University's \$104 million applied research and development initiative Metal Earth, was impressed with the positive impact DIGGER had on his 2019 class. He invited Me Too Mining to conduct its program as part of the health and safety training his students received before they were sent for summer work in the field. "We need to train them on workplace safety but also what the workplace environment is going to be and their rights as an employee and what is inappropriate in a workplace," said Sherlock. "Susan and her colleague [Gartley] were very effective and I think it opened the eyes of the students that this is a potentially dangerous environment you can get into but that you also have a right to health and safety."

DIGGER's benefits extend to reducing all forms of discrimination, not just misogynistic actions, according to Lomas.

"The same tools that deal with sexual harassment are the ones to deal with any inappropriate behaviours whether it is racism, bullying, intimidation, or discrimination," said Lomas. "It's putting the light on the situation so it just doesn't keep happening in the dark."

That was one of the reasons Cape Breton University geology professor Jason Loxton invited Me Too Mining to speak to his engineering students. "We were about to send a group of students predominantly from India into northern rural Alberta, which might not necessarily be the most ideal environment for them," he said. "They had to potentially prepare for racialized harassment in work-camp settings."

The vast majority of the comments Loxton received from the students after the presentation were very positive. "Some of them were from people who expressed both a complete lack of awareness before that there was a [harassment] problem and a really strong desire to do things to change it afterwards."

There was an additional reason why Loxton invited Me Too Mining into the classroom: out of approximately 180 students,

over 90 per cent were men. "The goal was to recognize that same gender imbalance is represented in industry, I wanted to create 180 allies."

Some participants in the DIGGER program have gone on to share stories with Lomas about times they witnessed harassment but did nothing.

"I'd actually be shocked if you could find anyone who has spent time in the field who does not have a story that they probably shrugged off but should not have shrugged off," said Loxton.

Many feel guilty by their inaction, explained Lomas. She shared an example of a man who told her that on his first job after graduating from university, he witnessed the cooks being repeatedly harassed by the diamond drillers, who were significantly older than him. "He was intimidated by them so much that he remained silent, but he still carried the guilt and shame 30 years later."

Since launching Me Too Mining, Lomas has also heard from men who have been victimized in mining workplaces. In a hyper-masculine culture such as in mining, male victimization remains a hyper-taboo subject, but the reality is that, "men also get sexually harassed, bullied and even sexually assaulted," said Lomas. "And that's a conversation that hasn't really been a part of the topic in the past, but we've brought it into our discussions, so we're very inclusive."

Working around COVID-19 limitations

Between February 2018 and March 2020, Me Too Mining worked tirelessly to raise awareness through having a presence at industry conferences. "Our bystander training tool was really starting to impress a lot of people and we were having conversations with mining companies about giving our course and then COVID hit," said Lomas.

Slowly, things have been picking up since then, but it seems the industry overall continues to be gobsmacked by revelations of sexual harassment rather than rolling up its sleeves and supporting Me Too Mining's initiative for culture change. The organization's phones have not been ringing off the hook with offers of funding or company-wide bookings for the program. The *Financial Times* article mentioned some of the performative changes BHP has implemented, such as installing additional security cameras, providing security escorts for women, and limiting in-camp alcohol consumption to four drinks per day, but it did not mention DIGGER while quoting Lomas or include any reference to mining companies implementing similar programs of their own. Instead, it stated that "employees of BHP and other mining companies have been trained to act with respect for some time."

"The biggest challenge is how do we implement [company-wide culture change regarding sexual harassment and assault] and broaden the scope of our health and safety training in mining to include the types of challenges that are not necessarily as black and white as 'don't use certain types of shovels on a conveyor'?" said Gartley. "Right now, we are a group of volunteers. All of us have other full-time jobs and we're doing this in our free time because we think this is important and it's not something that currently exists widely in the industry."

It seems the ball is now in the industry's court. **CIM**

Susan Lomas' CIMVTL21 presentation, "Safe, Inclusive and Respectful Workplaces through Allyship and Active Bystanders," can be accessed on the CIM Academy website: <https://academy.cim.org>



There for you, on your worst day

Ontario Mine Rescue's Ted Hanley on getting it right when everything goes wrong

By Herb Mathisen

You can't crystal-ball everything. Ted Hanley, general manager of Ontario Mine Rescue, does his best anyway, as do the staffers and volunteers who work to save miners' lives when accidents occur.

After all, the 92-year-old organization was created in response to a problem many should have seen coming. In 1928, fire crews were brought in from Pittsburgh, Pennsylvania, to put out a fire at the Hollinger mine in Timmins because no local or provincial firefighters were capable of responding to the underground blaze. The fire killed 39 miners, which prompted the creation of a local, specialized response team. As Ontario Mine Rescue — and its mandate — has evolved, so too has its approach. Now, it focuses on addressing potential shortcomings long before disaster strikes.

The organization employs mine rescue officers at rescue stations in every mining community, split up into eight districts. Officers train volunteers on site, help operations keep their emergency plans up to date, set mines up with equipment and also provide support during emergencies. Officers work closely with mines from the first shovel in the ground until the lock goes on the gate at closure. "They are working at mine sites typically four days a week," said Hanley. "Mine rescue officers are at various mine sites every week of the year to make sure that a process is in place should anything go wrong."

Although Hanley said there are thankfully fewer mining emergencies than ever, the trend towards deeper and more expansive mines — translating to longer emergency response times — means miners still need to take mine rescue seriously.

CIM: How does Ontario Mine Rescue work with mine operators?

Hanley: All the mines pay worker insurance premiums to the provincial government through our Workplace Safety and Insurance Board. A very small percentage of that pot collectively funds their mine-rescue programs. The fees are an important requirement, but they get a great benefit in return: they receive mine-rescue equipment, a mine-rescue process that is continually improving, mine-rescue training and support should something go wrong at their mine.

CIM: What is a typical mine rescue call today?

Hanley: On average, in any given year, it's a split between fire and non-fire mine rescue. But it shifts slightly in either direc-

tion, where it could be two-thirds of one, one-third of the other. In terms of fires, historically and today, we still see that diesel equipment is the number one cause. It's the cause of three-quarters of the mine fires we deal with.

CIM: How many mine rescue operations occur each year?

Hanley: In 1980, you would have had in the neighbourhood of 100 instances of what are called reportable fires or reportable unexpected occurrences — things that may have required mine rescue teams to investigate. We're typically down to somewhere in the neighbourhood of 20 mine rescue operations that we conduct today, on average, in the province of Ontario. It is quite a drastic decrease.

CIM: Can that cause mine operators to become complacent?

Hanley: The reduced frequency of these things is a little bit scary to us because we're in the business of educating people — responders right up to the managers and corporate executives. Things can still go sideways fast on you in an underground mine. It's not like in an office building, where people can just use the emergency exits and make their way out. In a mine, you don't have that luxury.

Mines are not allowed to intentionally opt out of the mine rescue process because they've been having a good run of safety performance. Still, we're trying to impart to [miners] that even though the frequency is down, the severity of those instances remains extremely high. And the potential for loss of life — either the mine workers who are affected, or the responders themselves — is still extremely high unless we have some critical controls in place to prevent that.

That's really an important discussion because of how many mines can go so long without a serious occurrence. They can go through several management changes. They can go through corporate changes and personnel changes. There's a real risk unless our process is still reminding them that there could be a gap that forms and we would not be able to respond to something that happens at their site.

CIM: What kinds of gaps can develop?

Hanley: What will typically happen is even though our [mining] partner is absolutely supportive and sends their workers for training and allows us to set up equipment at their site, little things can start to slip away.

For example, we train the managers of mine sites. We know they're not going to be using rescue equipment and going underground during emergencies, but legally they're in charge of that emergency process when something goes wrong. We can provide a 16-hour course on oversight of an emergency and work with them to understand critical tasks and responsibilities. That segues usually into them working with their health and safety staff, making sure that they have an appropriate site emergency-response plan and that everyone's up to speed.

Now, if a mine goes some time without an incident, we may observe the management of that site not participating in that mine rescue management training for several years. That's where you can have that small gap forming, where our mine rescue officer might notice a site emergency-response plan that's not keeping up with advances at the site or notice deterioration of some elements of the mine's response capability. That mine might have become more expansive in the last five years. Maybe they've added a new section. Maybe they've gone deeper and there needs to be individuals constantly looking at whether or not the plan they have in place is still applicable.

CIM: Is it more important than ever to stay on top of plans with deeper, more expansive mines?

Hanley: I was fortunate to work at one of the deepest mines in the world. It is actually four mines on top of each other, going deeper and deeper and deeper. Like many underground mines, when they were developing the original mine plan near surface, they were not thinking they would be down 10,000 feet below that mine, so it's important, that as a mine progresses, they design not only how to get the ore out of the ground, but also update their emergency response plan.

At one time, it only took 13 minutes to drive from the top to the bottom of the mine, now it takes an hour and 13 minutes. That's a big difference when someone has a heart attack or someone is barricaded behind a fire with 30 minutes before their oxygen runs out. These are the things that our staff are discussing with the mine operators, in partnership, to make sure that we're on top of it.

Skyscrapers don't even begin to describe the spookiness of it, when you think about it. Take the world's tallest building — the Burj Khalifa in Dubai — and superimpose it next to the Laronde or the Kidd mine. It's dwarfed. Those mines are three kilometres deep, and we're talking hundreds of feet for the largest skyscrapers. Being at the bottom of an expansive mine — or, in Western Canada, at one end of a horizontally expansive mine, and trying to reventilate 30 kilometres of horizontal expanse, which takes days to reventilate — it's eye-opening for people not familiar with mining. It's a good reminder for those familiar with mining that there's a reason we're not just calling the local fire department.

CIM: What else can affect emergency-response plans?

Hanley: When new technology comes in or when the mine process changes. If they bring in battery electric vehicles (BEVs), that's going to reduce diesel particulate emissions in their mine, so that's great for everyone involved. But we just want to understand, how does a BEV catch on fire versus how does a diesel vehicle catch on fire, because eventually they're both going to catch on fire. It may not be today. It may not be tomorrow. But something will go wrong and a fire in a mine is a problem that we need to be able to resolve.

CIM: What's so different about a BEV catching fire underground?

Hanley: A fire in the mine is a fire in the mine. Ninety per cent of that process we already understand. It's just the fuel source, the potential interactions with humans, and what we've done wrong to cause that, or what we've done wrong to respond that makes up the other 10 per cent.

It is a little disheartening for us to hear if there is a problem between battery cells — where this process runs away from us — that we may have to let the fire burn itself out because we currently do not have an extinguishing agent that we can use to eliminate that fire completely by stopping the reaction.

Several years ago, when we saw the first BEVs introduced into the province, we included that in our training of volunteers, regardless of whether their operation was using them. All 900 volunteers in the province received training and awareness on that. It was included in our mine-rescue standardized evaluations and in our competitions, to say this is going to be something that is coming and we need to begin preparing for this now.

CIM: What new mine rescue trends or technologies are you excited about?

Hanley: Mining, despite its mega-dollars and the scale of what goes on globally, is still a niche industry compared to a lot of other big industrial sectors. The underground-mine-rescue process is a real niche within that, so there's not a lot of dedicated development on it. A lot of what we do is just piggy-backing on other technologies for bigger markets — technologies for municipal firefighting and so on — and applying it to the mine environment. Keeping up to speed with all of this stuff, and then determining whether it applies to underground-mine rescue, is pretty important.

If we can get any sort of information related to a hazard before human beings go anywhere near it, that's of critical importance to us. We put a backpack — a breathing apparatus — on these people and send them into a mine where everyone else has run away or refuted themselves in place. We have no idea what's going on and we say, "Go check it out. Go take a look." That's where things like drones and unmanned aerial vehicles (UAVs) absolutely could help us. Not too long ago, there were no mines in Ontario with any form of wireless communication other than a leaky feeder radio. Now, mine rescue teams can use tablets underground to send video directly from underground and, again, get more information to those who need it, so we can make safer decisions. That concept of the unknown is what we're trying to solve with all these technology implementations.

Whether it's battery vehicles or it's expansive mining or entrapment of individuals, there's a lot of things that we really need to stay ahead of, but there's a limit to how many combinations of scenarios you can prepare for, really.

CIM: So, like they say, an ounce of prevention...

Hanley: The most bang for your buck in mine health and safety is really in that prevention side. Just like firefighters working at your local fire hall, they like putting wet stuff on hot stuff. But really, we should all be in the business of preventing that fire to begin with. Putting firefighters and mine rescuers out of work is, in theory, the safest thing we can do for them, but until that very distant future, we still have to have a safe mine rescue process. **CIM**



"Misabi," by James Faubert of the Temagami First Nation

Principles into practice

Codifying UNDRIP into Canadian law is only the beginning. The challenge comes in understanding how to implement it, and how to engage Indigenous stakeholders in meaningful consultations

By Tijana Mitrovic

Denendeh is the land of the Dene People. The one-million square kilometre area is located in the western part of the Northwest Territories, mainly south of the tree line. It is territory that the Dene Nation wants to both protect and manage. It is also an area that is rich in mineral resources

"We have gold, diamonds, iron ore, all kinds of minerals. And the Aboriginal People, we want to be involved in the whole [mining] process," said Dene National Chief Norman Yakeleya.

It is also an area that has suffered because of mining. The Dene People live in the shadow of the former Giant gold mine and the 237,000 tonnes of arsenic trioxide dust it left behind.

"We have experience where Giant mine came in without any regard to the Dene or Denendeh, and look at the mess that it's now in. Look how it's devastated our communities. People in Denendeh talk about it with a sore heart, and [have vowed] to fight for many years to clean up the Giant mine."

The path to addressing legacy sites and participating in new mining projects now seems clearer for the Dene and for the other Indigenous People of Canada. This summer, Canada went from being one of four members of the United Nations (along with New Zealand, the United States and Australia – all strong mining nations) who voted against adopting the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) in 2007, to agreeing to codify UNDRIP into federal law. The Government of Canada and the Government of Northwest Territories are following the lead of the Government of British Columbia, which adopted UNDRIP in late 2019.

A lot is still up in the air as to how implementation will occur and what the long-term effects will be, especially given the nature of UNDRIP, which is more of a framework against which future laws will be written and current laws will be aligned rather than a simple checklist of dos and don'ts. UNDRIP will, however, further reinforce the constitutionally protected right that governments need to have meaningful consultation with Indigenous People, especially when it comes to resource extraction on their traditional lands.

UNDRIP lays the responsibility of consultation with Indigenous Peoples at the feet of government, even if it is a responsibility that is sometimes shirked. For the exploration and mining companies that have taken consultation seriously and have engaged in good-faith negotiations with traditional landholders, it is likely that not much will change. For others, however, UNDRIP adoption could bring a hard close to old ways of doing business, as Indigenous People will require seats at the table before any new mining project that impacts them can begin.

"I strongly believe that this implementation of the declaration carries important symbolic significance, signifying the federal and territorial government's commitment to govern alongside Indigenous governments, rather than over them," said Chief Yakeleya. "This is a step in the direction to correct the wrongs from the past."

Adoption and implementation

In June, the federal government passed Bill C-15 (which became the *United Nations Declaration on the Rights of Indigenous Peoples Act* after receiving Royal Assent) bringing the UNDRIP framework into Canadian law.

The declaration consists of 46 articles, which recognize the basic human rights of Indigenous People as well as their rights to self-determination. It specifically says that governments must consult with Indigenous People about "any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources."

In November 2019, British Columbia's provincial government unanimously passed Bill-41, also known as the Declaration on the Rights of Indigenous Peoples Act (DRIPA). While the newly adopted Act mandated that the government create an action plan and annually report its progress on fulfilling UNDRIP articles, the COVID-19 pandemic hobbled its implementation until recently. The provincial government only published its draft action plan in June 2021, and called for Indigenous Peoples to provide feedback.

For Merle Alexander, a specialist in Indigenous resource law and principal of the Indigenous law group at the Vancouver-based law firm Miller Titerle + Company, the implementation of UNDRIP is a significant task. Alexander is a member and heredit-

itary chief of the Kitasoo Xai'xais First Nation in British Columbia, and was part of a co-drafting team for DRIPA, as well as a British Columbia representative during the federal government's national engagement on Bill C-15.

"[What] we have found in British Columbia... is that the requirement to make laws consistent [with DRIPA] is actually quite [considerable] and requires you to actually change the way you normally develop laws," he explained. "If you don't do all the work, and create proper mechanisms for that to occur, then you're going to go off-side almost immediately in your first legislative session that comes up."

In addition to a need for concerted effort, there is a need for education, said Sharon Singh, a lawyer and partner at Bennett Jones LLP. Singh serves as a member of the Wet'suwet'en Community Advisory Council and as senior policy advisor to the Mining Association of British Columbia. "When DRIPA came into effect, the sky didn't fall in British Columbia... but there was a discernible pause in certain levels of government decision-making... [and] there was confusion amongst public officials regarding what DRIPA did and did not do," Singh explained. "Although the government had a communication plan in place that explained this is an enabling piece of legislation that needs further steps to actually implement certain components... there was not sufficient internal education, which inevitably led to further delays and mismanaged expectations."

Despite uncertainty, Singh said that the mining industry has been at the forefront of building partnerships with Indigenous People because mining companies have been working in Indigenous Nations' backyards. "Miners are a lot more alive to the fact that Indigenous Peoples are rights holders and Indigenous Nations title holders, so it wasn't new concept to adopt... Predominantly, the industry is very savvy and has led the way."

Seeking local knowledge

At Red Chris, going from project to production was a collaborative effort between the company operators and local Indigenous communities. Located in northwest British Columbia, the Red Chris gold and copper open-pit mine began production in 2015.

Shortly after acquiring its 70 per cent share of the Red Chris mine in August 2019, Newcrest Mining signed a comprehensive impact, benefit and co-management Agreement (IBCA) between Newcrest, the Tahltan Central Government (TCG), the Iskut Band and the Tahltan Band, which acts as the basis for a life-of-mine partnership between the parties.

"Working with Indigenous groups is not just a matter of paying lip service to local groups where they are present," said a Newcrest spokesperson. "We started by seeking the advice of experts, both internal and external, with local knowledge, and paying specific attention to the social context."

The company began working to support commercial development within Tahltan Territory, as part of the IBCA implementation, including training Tahltan community members for production and technical engineering jobs and developing partnerships with Tahltan businesses such as Tahltan Forestry for logging services. Newcrest also uses its cultural heritage management system – a series of cultural heritage surveys and assessment programs – for all of its sites. In practice, this means working with community relations employees, archaeologists and anthropologists and the landowners' representatives to identify cultural heritage sites and to preserve them.

“The ongoing guidance and input from the Tahltan leadership and communities is integral to the design of meaningful engagement approaches,” said a Newcrest spokesperson. “Meaningful engagement allows us to ensure the operation incorporates the views, concerns and knowledge of the Tahltan Nation.”

This level of engagement can also have a positive effect on a company’s sustainability, Singh explained. “Indigenous engagement is a fundamental part of a company’s environmental, social and governance (or ESG) performance, it’s a huge part of the social performance, it’s a huge part of governance,” she said. “It’s one [element] that actually transects all of the ESG pillars, and UNDRIP is part and parcel of that. For miners, they’re going to be asked when they enter into a community if they support UNDRIP and how they do it.”

Consultation helps promote reconciliation as well. “The Aboriginal people need to be at the table, from the beginning right to the end,” Chief Yakeleya explained. “It’s critical that we have respectful dialogue and collaboration for all the stages of the mining and resource projects. We want to be treated as equals and respectful partners, to fully participate in the mining industry. For us, this is part of reconciliation, by creating important impact benefit agreements (IBAs) and sharing mineral-tax revenues.”

From consultation to co-development

For Michelle Tanguay, head of sustainability and community relations at Northisle Copper and Gold, co-development of a project is key to building relationships between miners and Indigenous groups. “It sets the stage for equal footing, ensures that any communications are put into the right context, and confirms that everyone has a shared understanding on the frontside,” she explained. “Like a common language, a common understanding.”

Northisle Copper and Gold owns the North Island copper and gold porphyry project, located near Port Hardy, British Columbia. The company recently completed an updated preliminary economic assessment and is now working on a pre-feasibility study. One of Tanguay’s priorities will be conducting community outreach with local rights holders.

“From a company perspective, we want to fit a reasonable timeline... and do the free, prior and informed consent piece on anything that we are submitting for authorization,” Tanguay said. “You need to balance those things very carefully in order to meet timelines. It is a challenge to put your application in because it might take up to a year in British Columbia, but you also want to have that discussion with the nation in advance.”

Tanguay’s attitude towards free, prior, informed and involved consent is that the earlier a mining company can engage with Indigenous stakeholders, the better. “You really need to do the informed piece even [earlier] to understand the larger context of what’s being proposed,” she said. “Fairness, honesty, transparency and communication are really part of that piece. The nation then develops processes, and we make sure that we do what we can to support that.”

On the path to a “new way to do business”

Mining companies are curious to see how the federal UNDRIP Act will be interpreted in law once fully implemented. There is

already discussion about the lack of clarity around potential legal changes to regulatory consultation activities.

“The Act has the potential of either creating greater legal certainty, where we know what the rules are around difficult issues like free, prior, informed consent, or, if the federal government doesn’t implement it and puts very little resources, they actually just add fuel to the problem,” Hereditary Chief Alexander said.

What is the solution? According to Tara Shea, senior director of regulatory and Indigenous affairs at the Mining Association of Canada, the government should administer enhanced guidance, training and policies to ensure that federal officials have the tools to meaningfully engage in regulatory consultation activities with Indigenous communities, as is the Crown’s duty. “Poor implementation of this legislation, including the failure to provide further guidance related to processes for Indigenous engagement on projects and on whether changes to existing processes are being contemplated, could set back relationships between mining proponents and Indigenous communities leading to tension at the project level.”

Shea explained that this legislation will not represent a major change in practice in terms of engagement and collaboration with Indigenous communities, at least for mining companies that follow MAC’s Towards Sustainable Mining protocol, as that was written with UNDRIP in mind. “Mining companies are leading the way in terms of forming partnerships with Indigenous businesses, with many mining companies spending millions annually on contracts with Indigenous service providers,” she said.

She added that the government will need to manage expectations about any upcoming changes needed to bring existing federal laws into alignment with the goals of the Act. “I don’t think that message was fully communicated, not just to Indigenous Peoples writ large or nations writ large, but to the public and even to proponents and industry,” Singh said. “What that has meant is that you still continue to have a lot of mismanaged expectations and therefore disappointment or confusion. And that just leads to uncertainty.”

Despite this ambiguity, companies can still reflect on their consultation style and plan what changes they will need to make to their processes to allow for adherence to future reforms, based on UNDRIP articles. “[Proponents] that really want project certainty for projects they anticipate will be around for the next five to 50 years will want to negotiate progressive agreements that allow for adaptations in the law, or have mechanisms within their IBAs that allow them to adapt to material changes in the law,” Hereditary Chief Alexander said. “No matter where the law eventually ends up in terms of mining law reform, they’ll be ahead of the mark.”

Going above and beyond

If companies are hoping to be ahead of UNDRIP’s curve, what can they actually do? According to Singh, miners should go beyond standard practices and take a community partnership approach to engagement.

“Everybody knows that if you have the nations on your side and have their support, then the likelihood of you actually getting the project built is much higher,” she said. “More and more, it’s not what’s acceptable, but what can we do... to make the nation successful?”

Indigenous Peoples' involvement should be sustained through its mine life. Planning mine reclamation in advance is one way to ensure that Indigenous involvement continues beyond project approval into development. "Too many mines are abandoned and too many mines need to be cleaned up," Chief Yakeleya said. "Mining companies should be working with the Aboriginal governments to ensure that they must clean up the land and restore it to where they first started working on it."



We want to be treated as equals and respectful partners, to fully participate in the mining industry.

– Chief Norman Yakeleya

Free, prior, and informed consent

Perhaps the most contentious article of UNDRIP, Article 32, grants Indigenous Peoples "the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources," and states that they will need to provide "free and informed consent" for projects on their lands. Critics of the Act argue this would give Indigenous People a "veto" over natural resource projects. While free, prior and informed consent is not defined in UNDRIP or the Act, "UNDRIP is more or less an affirmation of existing rights," explained Hereditary Chief Alexander. "It doesn't create rights unto itself."

Miners therefore should think of consent on a case-by-case basis, as every project and Indigenous stakeholder relationship is different. "Putting free, prior and informed consent principles into practice does not involve a 'one size fits all' approach," said a Newcrest spokesperson. "We embed early engagement into all aspects of our projects and aim to [incorporate] the results of this continuous engagement into project design and approaches. This includes developing mutually agreeable consultation and engagement approaches with Indigenous communities and groups that focus on creating mutually beneficial outcomes from our operations."

Consent is more than a duty to consult or a reactive approach when a conflict arises. It is living, dynamic and active throughout a mine's development, Hereditary Chief Alexander said. "I think for the most part, people get really worried about that because they think of consent as being too static, as opposed to it being a dynamic process where you have to maintain consent," he said. "And your actions and your level of information sharing and your trust in each other maintains consent."

While consultation can sometimes be a fraught practice, it is by sitting down at the table that parties develop understanding. "What it means to me is companies have to come and talk to us," Chief Yakeleya explained. "Anything they're going to do, anything they want to set out, they have to come and sit with the original landowners. Sit with the chiefs, sit with the community, and talk to us, listen to us and hear what we have to say. And listen to our concerns, listen to what we want in agreements, listen to our people's wishes and have an understanding in regards to the projects on the traditional territory."

Then there may be instances where consultation takes projects down a different path.

In April, Skeena Resources returned its claims for the Spectrum deposit near Mount Edziza Provincial Park to the Tahltan Nation in British Columbia. After consultations with the Tahltan, the company realized its ecological and cultural importance to the Tahltan Nation. Following this, the Tahltan Nation made a \$3.9-million investment in Eskay Creek, and the company worked with the TCG, the Province of British Columbia, the Nature Conservancy of Canada and BC Parks Foundation to establish a new 3,500-hectare nature conservancy.

There is still some confusion about how UNDRIP-guided regulations will mandate consent. "The decision makers don't quite know, do we need to achieve consent at all times or is it enough if we're following the process of engaging in consulting," said Singh. "When can we say 'this is enough' and we've done enough engagement or not done enough engagement? Where is the line? You're never going to have an answer to that with the way things are progressing, but you need to have more of an open conversation about it."

In effect, Singh said the Act lights a path the country is already on. "Our governments are a reflection of our society and where it's heading, and the policy wasn't heading in a space that wasn't going to implement UNDRIP."

For Chief Yakeleya, the Act signifies something more. "Canada has finally woken up, that the original owners are not going anywhere, we have lands, we have resources, and the original landowners need to be involved. The implementation of UNDRIP is long overdue – 153 years to be exact." 





Cheetah Resources' Clarence Pyke, Mathew Edler and Chris Pedersen at a Nechalacho ore pile.

A rare first in Canada

Cheetah Resources starts small at Nechalacho, Canada's first rare earth producer

By Herb Mathisen

The first thing you see as the single Otter touches down on Thor Lake is a dozen or so humble, wooden cabins poking out from a spruce tree backdrop above the rocky shore. If you didn't know better, you might think you have landed at a fishing lodge, roughly 110 kilometres southeast of Yellowknife, Northwest Territories.

But no, this is the site of Canada's first producing rare earth elements mine – and only the second in all of North America. Although Cheetah Resources' Nechalacho project is not going to break China's dominance of the market any time soon, the company – and its majority local, Indigenous workforce – is dedicated to proving that rare earths can be sustainably mined, sorted and extracted in Canada.

Still, everyone involved with Nechalacho is careful to temper expectations, even if this three-year demonstration-scale project has some larger ambitions. This initial phase of the project will focus on earning the social licence to operate from Indigenous stakeholders and mining the high-grade North T Zone, with a

measured and indicated resource of 9,102 tonnes of light rare earth oxides from 120,000 tonnes of ore grading at 9.01 per cent. Thousands of tonnes of rare earth concentrate – crushed and sorted bastnaesite rock that looks very much like pink gravel – will be barged across Great Slave Lake to Hay River, Northwest Territories. It will be stored there before travelling south by rail and truck to Cheetah's extraction – or "cracking" – plant, currently under construction in Saskatoon. Cheetah will then sell its final output, a rare earth carbonate, that customers will use to produce separated rare earth products, which are found in the very strong permanent magnets vital to electric vehicles and wind turbines.

Cheetah Resources is taking these three years to demonstrate that rare earth products from the Northwest Territories are acceptable to the global market and to earn the social licence to operate from Indigenous stakeholders. If it does, the company can scale up to mine the larger Tardiff zone to the south, which has the potential to keep the company in business in the North for generations.



Courtesy of Cheetah Resources/billbradenphoto

The 130-kilometre ice road helped to ensure Nechalacho was commercially viable.

Starting small

This summer, Cheetah Resources drilled, blasted, hauled, crushed and sorted ore from the North T Zone around the clock. The plan is to complete all the mining there before the winter freeze-up. Then, it will spend the next two summers sorting the rest of the bastnaesite ore, which hosts the rare earths, from quartz gangue. The work makes for an oddly pretty site. “We made our own roads with waste rock,” said mine manager Clarence Pyke, while driving along the bumpy, two-kilometre stretch from the main camp to the pit, which leads you over a pathway of glittering pink and white crushed quartz.

At the pit, four HD400 Komatsu haul trucks move ore to a mobile crushing circuit, where high-grade ore is crushed to between 10-millimetre and 20-millimetre widths, and low-grade ore down to eight millimetres. Gord Peckford, site superintendent, explained why the high-grade ore is not crushed too finely: “When you create dust, it means you’re losing the ore, right?”

Most of Nechalacho’s equipment – from its fleet of leased vehicles to its diesel generators and crushing circuit – was brought in over an ice road. Counterintuitively, Geoff Atkins, CEO of Australia-based Vital Metals, which owns Cheetah Resources, said the region’s cold climate helped instead of hindered the development of the project. “Coming from Australia, one of the things I admit I never truly appreciated was the beauty of an ice road because, from a capital side of things, it has a very low level of intensity. We can put an ice road in, for not a lot of money, across 130 kilometres. That makes a huge difference on what you can and can’t do for a project,” he said. Cheetah Resources has spent roughly \$20 million on construction and operating costs at Nechalacho. “If, on top of that, you added spending \$40 or \$50 million on a road, then that completely changes what that project has to look like.”

One of the most important pieces of equipment to travel over the frozen Great Slave Lake from Yellowknife was a TOMRA COM

Tertiary XRT sensor-based ore sorter. Roughly 80 per cent of mining applications for TOMRA’s sorters comes from the diamond sector, said Russ Tjossem, applications engineer with the company, who was on site in late July for commissioning and training Indigenous operators. “This is the first I’m aware of for rare earths,” he said. “This is one of the easiest sorts I’ve ever seen. This material was made for sorting.”

The sorter gives Cheetah the ability to separate even more waste rock from its ore, allowing it to ship a higher-grade, 35 to 40 per cent total rare earth oxide concentrate to its extraction plant.

Jeremy Catholique, a sorting operator from Łútsël K’è, N.W.T., now living in Yellowknife, fired up the sorter and explained the process. Crushed ore is fed onto a conveyor that leads into the sorter. There, an X-ray scans the feed and, before it has travelled two feet, a valve hits each rock with a puff of air, knocking it onto one of two conveyors. One leads to the rare earth concentrates pile; the other to a waste rock pile. “There are 192 valves,” said Catholique. “They’re really tiny.”

Cruze Jerome, a sorting operator from Inuvik, N.W.T., also living in Yellowknife, provided a quick tour of the control room. He can take a snapshot of the material inside the sorter at any time, while receiving constant updates on the total volume of ore, and ore and waste percentages. At this stage of commissioning, Cheetah is putting low-grade ore through the sorter. Jerome said it was roughly 10 per cent concentrate.

Cheetah received a \$1.26 million interest-free loan from CanNor – the Canadian Northern Economic Development Agency – to help pay for the sorter and its installation, based on its innovative use of the technology. Cheetah will pay it off in monthly installments over ten years.

To date, Cheetah Resources has spent roughly \$15 million at Nechalacho and in Saskatoon, said Mathew Edler, executive vice-president with Cheetah, with additional operating and consum-



The COM Tertiary XRT sensor-based ore sorter provides the background to Yellowknives Dene First Nations drummers during the commissioning ceremony.

able costs to come at the Saskatchewan plant. When all the construction is completed, the total cost is expected to be \$40 million.

Cracking the code

At the Saskatoon extraction facility, the rare earth concentrate is crushed down to a sand, put through a rotary furnace and heated up to 400°C. Edler explained that the heat allows Cheetah to dissolve the rare earths, which will eventually take the form of a rare earth carbonate – which he described as “a pale blue powder” – that is sold to separation plants.

Cheetah has signed a 10-year lease for a bastnaesite extraction facility located right next door to the Saskatchewan Research Council’s new \$31 million rare earths processing facility, which will include both a monazite rare earth extraction, as well as a separation plant, once construction is finished. Cheetah hopes to begin commissioning its facility this winter, and provide a shipment to its first customer within the first six months of 2022 to begin generating revenue.

Cheetah has a five-year agreement to sell 1,000 tonnes of rare earth carbonate ex-cerium annually to REEtec, a Norwegian company that specializes in separating rare earths. With so many technological, logistical and supply chain details to iron out, it is understandable why Cheetah is taking a gradual approach to ramping up Nechalacho. “The reason we did this was to get everybody comfortable with what we’re doing,” said Edler. “Rare earths in general have a very long customer acceptance period.” In other words, customers like REEtec need to know the company can deliver the exact rare earth carbonate product it has promised. “They will actually take small quantities of the material – potentially for 12 months, 24 months, 36 months – until they are confident that we can produce a quality and a consistency.”

Cheetah will also continue to optimize its plant to provide its customers with the most attractive product possible. Cerium, for instance, can comprise up to 50 per cent of the rare earth carbonate product, but in recent years, Edler explained, the element has become a nuisance to separation facilities because there is little market for it. “Every gram of cerium we get out is a gram less that they have to get out and our process is cheaper to get it out than theirs,” he said. REEtec would rather have 1,000 tonnes of rare earth carbonate ex-cerium (without cerium) than 2,000 tonnes with cerium. “There’s a cost sharing there,” Edler



Flying into the remote camp, wooden cabins greet visitors and employees alike.

said, adding that the companies can work together to find the best arrangement because Cheetah is not in competition with REEtec. “There’s all these little things we’re learning.”

Going local

In late July, Cheetah celebrated the commissioning of the ore sorter by flying members of the Yellowknives Dene First Nation (YKDFN), as well as Yellowknife’s mayor, to the site for a visit and a Dene drum ceremony. There, David Connelly, Cheetah’s vice-president of strategy and corporate affairs, listed the project’s benefits to the territorial economy. He said more than 100 local vendors have been involved in the project thus far, with over 85 per cent of the procurement contracts having gone to Indigenous suppliers. Barge shipments south to Hay River would also nearly double the amount of non-fuel-related freight going through the port over the next three years. This freight would be heading out of the territory, reversing the trend for a region that depends mightily on importing goods, food and fuel from the south.

For its main mining contractor, Cheetah hired Det’on Cho Nahanni Construction Corp., a joint venture 51 per cent owned by the YKDFN. Paul Gruner, president and CEO of the Det’on Cho Corporation – the YKDFN’s business entity – said he believed this marks the first time a First Nation in Canada was the contract miner on its traditional lands. Gruner said there have also been discussions between the First Nation and Cheetah Resources about the possibility of the YKDFN taking an equity stake in the project.

Over 70 per cent of Nechalacho’s employees and managers are Indigenous and, when mining, drilling, blasting and sorting are occurring, there are nearly 40 workers on site. (Operations will slow down considerably in winter; if drill crews are not around, there will be just two care and maintenance staff on site.) For now, Cheetah Resources has 67 workers on the rotation schedule. But there is potential to double this if the Tardiff scale-up proceeds in 2024.

As Cheetah fine-tunes its North T Zone operation, it continues to drill out the much larger Tardiff deposit to the south of its main camp. Cheetah’s brass understands that if it wants to continue mining at Nechalacho, it needs to start the permitting process for Tardiff soon, with Edler and Connelly both noting it can take roughly two-and-a-half years in the Northwest Territories to get its permits in place. To assure a continued supply of

concentrate for Cheetah's cracking facility in Saskatoon, the company purchased the Kipawa and Zeus rare earth projects near Temiscaming, Quebec, in August 2021.

Cheetah expects to use the ore sorter at Tardiff, although there may be a need to use flotation to separate the ore further. (For now, Gruner likens mining at Nechalacho's North T Zone to an "aggregate quarry," due to a lack of any secondary processing or chemicals used.)

Connelly said most of the exploration work at Tardiff right now is focused on mine planning. The resource, he said, is fairly well understood and explored, as more than \$120 million had been spent by previous owners to develop Nechalacho.

In fact, Thor Lake has been explored since the 1970s, when geologists came looking for tantalum, beryllium and uranium. (Edler said he visited the site in the 1980s, back when miners were not even interested in rare earths. Cheetah geologist, Chris Pedersen, was part of a team exploring the site for beryllium in the 1980s.)

In the mid-2000s, Avalon Rare Earth Metals acquired the property and spent more than a decade developing the project. In June 2019, Cheetah Resources purchased the near-surface Upper Zone of the North T Zone and Tardiff deposits (basically, everything at Nechalacho above 150 metres above sea level) for \$5 million. Tardiff's Upper Zone has a measured, indicated and inferred resource of 94.7 million tonnes grading at 1.46 per cent

total rare earth oxides. Avalon still owns the rich, but more complex Basal Zone – everything below the Upper Zone.

Cheetah's next phase of Nechalacho from Tardiff could possibly produce five times more rare earth carbonates than the North T Zone's annual output, but the project will still be small by traditional mining standards. "Separated rare earth products: the world production and consumption are 130,000 to 140,000 tonnes a year," said Edler. At most, Cheetah Resources might sell 10,000 tonnes of rare earth carbonates a year from its Saskatoon facility – with some of that feed possibly coming from other rare earth projects it is developing, like Wigu Hill in Tanzania as well as Zeus and Kipawa.

Still, if the Tardiff expansion goes ahead, it could provide stable jobs to a couple generations of miners in the Northwest Territories, at a time when the future of the sector in the territory looks grim. It would also help loosen China's stranglehold on the rare earths market, which would give end-users added certainty, as the country has been known to influence prices through tariffs and by rationing or flooding production.

And it would add to the global supply of metals that continue to find new applications in high-end technology. "A tiny little pinch of rare earths could make a massive difference to magnets, fibre optics, LCD screens – all these little weird and wonderful things, and they're constantly discovering some really cool new ones," said Edler. **CIM**



DISTINGUISHED LECTURERS 2020-2021

THE PROGRAM

The CIM Distinguished Lecturers program started in 1968 and has continuously provided a lineup of individuals who have shared their knowledge with the mining community for over five decades.

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The Sandhill fen represents one of the industry's first examples of mine reclamation over a foundation of treated tailings.

Tailings – from risk to reward

Through advanced technology, tailings are shedding their bad rap and becoming a key solution to today's mining challenges

By Amanda Graff

The global mining industry produces billions of tonnes of tailings each year. While a necessary by-product of mining and mineral processing, when not processed or contained properly, tailings can be dangerous, carrying the risk of leaching toxic metals and sulfides into the environment.

In light of this risk, ground-breaking methods have been developed to dramatically improve tailings management and reduce the threat of environmental contamination. Recent innovations are taking this a step further to not only mitigate hazardous effects, but also harness tailings as a valuable source of economic recovery and a key component in transforming former mines into thriving watersheds.

Optimizing contaminant removal

Hard rock mining, mineral processing and metallurgical extraction can all potentially release large quantities of waste into the ecosystem. In gold mining, cyanide is often used to leach gold from the ore, which subsequently ends up in the mine's tailing ponds. Once contained, tailings quickly settle, producing supernatant water with nitrogen-based contaminants.

Conventional approaches to removing these contaminants have their limits due to the harsh conditions that can sometimes be found on a mine site. For example, a common method involves the use of a biological reactor, which requires a regulated temperature in order for bacteria to grow.

One possible treatment, however, seemed to be less dependent on temperature, so an 18-month project was initiated by ASDR Canada to verify the effectiveness of ozonation on nitrogen-based contaminants at a full-scale level. The project is

funded by the Ministère de l'Économie et de l'Innovation du Québec (MEI), the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP), Eldorado Gold, Agnico Eagle Mines and ASDR.

“Every mining project is faced with a wide variety of contaminants, but ammonia nitrogen is particularly complex to treat and there’s no silver bullet,” explained Pascal Marcotte, water treatment engineer with Agnico Eagle, and formerly with ASDR. “We saw a promising opportunity to develop a process that offered fewer drawbacks than existing solutions.”

Ozonation describes how ozone is dissolved in water and reacts with certain contaminants to reduce toxicity. The process treats commonly found contaminants, including thiocyanate, cyanide, cyanate, ammonia nitrogen and nitrite. When ozonation is applied, the contaminants become oxidized through a trickle-down effect by which thiocyanate becomes cyanide, cyanide becomes cyanate, and so forth, until the final product of nitrate is achieved. The ozone is produced onsite using concentrated oxygen and electricity.

“There’s over a dozen technologies that can individually treat these contaminants, but ozonation can treat them all at the same time,” said Marcotte. “It’s less complex to operate and can be used in a wide variety of conditions.”

The laboratory phase of the project took roughly four months to complete and was carried out using equipment provided by the Mineral Technology Research and Service Unit (URSTM) – a consortium of higher learning institutions located in the Abitibi gold belt. The processing unit allowed for small-scale, semi-batch testing that was inexpensive to implement.

Synthetic effluents and four real mine effluents were used to test the performance of ozonation on nitrogen-based contaminants. The tests relied on a calculation that Marcotte had developed known as Ozone Utilization Efficiency (OUE), which provides an accurate index to measure the amount of ozone applied that successfully targets the contaminants. For example, if 1,000 milligrams of ozone are applied per litre of contaminated water but only 800 milligrams target the desired contaminants, an OUE of 80 per cent is achieved.

During lab trials, contaminant removal rates of thiocyanate and cyanide consistently reached above 97 per cent, while removal rates for ammonia nitrogen and cyanate varied from 59 to 99 per cent, and 47 to 99 per cent respectively. Overall, the OUE achieved on all real mine effluents reached above 90 per cent.

Results also showed that pH levels have a high impact on process efficiency, while temperature has little to no impact, verifying that ozonation isn’t temperature dependent.

ASDR is now performing field-pilot testing. Detailed engineering of a commercial ozonation plant is also under way and is expected to be completed by the end of this year.

“When comparing ozonation to alternative approaches, its simplicity and ease-of-operation makes for a strong case to build a full-scale ozonation plant,” said Marcotte. “This is exciting because it means that ASDR will likely be able to fully develop the technology and bring it to market.”

Boosting recovery rates, producing metal onsite

In response to declining production rates and ore quality across the globe, mining companies are turning their attention to advanced leaching processes that vastly improve economic recovery rates from lower grade concentrates and mill tailings.



Courtesy of ASDR Canada

Ozonation is a process by which ozone is dissolved in water and reacts with contaminants to reduce toxicity.

The Trevali Mining Corporation is leading the way with its pilot plant testing program that involves sending run-of-mine and milled material from its polymetallic Caribou mine to FLSmidth’s Rapid Oxidative Leach (ROL) process testing facility in Salt Lake City, Utah.

ROL refers to a mechano-chemical process that utilizes a series of stirred media reactors (SMRts) in tandem with conventional stirred leach tanks to achieve fast kinetics and metallurgical recoveries as high as 97 per cent in roughly six hours.

Enhancing the volume ratio between SMRts and stirred leach tanks balances mechanical and chemical processes while slowing down grinding rates, which results in reduced mixing and energy costs. Low-energy grinding also improves the selective dissolution of minerals.

“We chose ROL for a number of advantages such as high recovery rates, suitability to a wide variety of grades, and reduced investment and operational costs,” said Derek du Preez, chief technical officer at Trevali. “It’s also a safer process because it runs at a lower temperature and pressure when compared to alternative solutions.”



Rapid Oxidative Leach utilizes a series of stirred media reactors in tandem with stirred leach tanks to achieve fast kinetics and metallurgic recoveries.

The Caribou mine, in New Brunswick's prolific Bathurst Mining Camp, was selected for the pilot program in support of Trevali's strategy to unlock the mine's true value by monetizing minerals and metals that have never been monetized before.

"ROL technology has the potential to transform the Caribou mine, extending its life beyond five to six years through the treatment of run-of-mine [ore] and tailings, and the production of precipitate or metal onsite," said Ricus Grimbeek, president and CEO at Trevali.

Metals and minerals derived from Caribou are typically recovered at rates of 78 per cent zinc, 62 per cent lead and 35 per cent silver. Initial results from the pilot program revealed increased recovery rates well above the current rates.

ROL also minimizes costs and environmental concerns associated with shipping concentrates to a smelter, which carries a heavy price tag. Instead, metals can be recovered onsite, which will allow the mine's flotation circuit to be replaced with atmospheric leach vessels and a solvent extraction and electrowinning train. This offers an optimized approach to recovery with a lighter carbon footprint.

The next phase of the pilot program will occur at the Caribou mine, to test larger volumes of run-of-mine ore and milled tailings. This step will be crucial to verifying that the batch testing results can in fact be achieved in a continuous operation.

"The ability to produce metal onsite is a game changer that can be extended to other mines throughout New Brunswick, transforming the entire mining district," said Grimbeek. "This will pave the way for the production of downstream products such as zinc oxides for battery manufacturing in support of low carbon initiatives. We even foresee the potential for a battery manufacturing facility right here in New Brunswick."

From open-pit mine to thriving watershed

On the other side of the country, tailings are playing a major role in land reclamation within the oil sands industry. Once bitumen has been extracted from a mine, companies operating in Alberta are required by law to remediate and return the land back to a trafficable landscape that can sustain wildlife and vegetation.

Oil sands producer Syncrude is leading with the creation of the Sandhill fen, a former open-pit mine that is now a thriving watershed. The project represents one of the industry's first examples of mine reclamation over a foundation of treated tailings.

"The goal was to recreate an environment that had equivalent land capability to what existed prior to oil sands mining," said Jessica Piercey, Syncrude's Mildred Lake hydrogeologist. "We had an ideal project area – an open pit, roughly 50 metres deep, that had been filled in with composite tailings and was ready for reclamation."

Located at the northern end of the company's former East mine on the Mildred Lake site, the Sandhill fen incorporates forested upland areas with wetlands across a 57-hectare watershed.

Before the watershed could be developed, the open pit needed to be filled. This was accomplished with composite tailings (CT), which combines a sludge-like substance known as fluid fine tailings (FFT) – recovered from tailing ponds and comprised of sand, silt, clays and potentially residual bitumen – creating a material that consolidates rapidly. Once deposited in mined-out areas, the tailings release water and settle, allowing for the remediation of FFT.

"The presence of tailings pore water is well suited to developing wetlands as the material releases water quickly, improving strength and density while delivering a viable water source," explained Piercey. "Composite tailings provide an ideal method for sequestering fine tailings over the long term, helping to reduce our mining footprint."

Once the pit was filled, it was capped with sand and soil, upon which landscapes were built that provide a trafficable cover for people, animals and equipment. Sand caps were designed to facilitate the placement of hummocks and lowland areas while directing the flow of surface and ground water in such a way that encourages forest and wetland development.

A variety of plants were introduced across the landscape, along with more than 100,000 trees and shrubs. These were joined by many other northern boreal wetland species that sprouted independently from seed banks in the soil.

The Sandhill fen now serves as an outdoor laboratory, where researchers and academics come to test reclamation strategies and conduct water and carbon balances. Syncrude also hosts Elders tours on the site to gather feedback and perspectives from local First Nations communities that will help to inform future reclamation projects.

"This initiative has created an incredible sense of community," said Piercey. "We've already worked with seven universities on various research projects to study water, soil, wetland and upland plants, and the impact of weather."

Last year, Syncrude released a knowledge synthesis document that compiled learnings from the Sandhill fen in addition to the company's more than 20 years of research, development and operational experience with regards to sand-capping and CT technology. According to experts consulted by the company, the synthesis validates the commercial use of the technologies based on positive physical, chemical and ecological outcomes achieved by Syncrude.

Now that commercial use of the technology has been validated, Syncrude will leverage the reclaimed East mine to pursue the first full-scale landscape performance evaluation of a commercial sand capped CT deposit in the oil sands industry.

Once considered only as a troubling source of contamination, technological breakthroughs have made it clear that tailings can mean more than just waste. Rather, they can serve as an asset to reach green mining goals, uncover value, and leave behind clean water, rehabilitated landscapes and healthy ecosystems. **CIM**



CIM President-Elect Anne Marie Toutant tees off at the CIM Toronto Branch annual CIM/CMP Frank Grieco Memorial Golf Tournament

Tee time

After a year without CIM branch golf tournaments, this long-standing tradition is back on course

By Michele Beacom

CIM branches across the country hit the greens this summer, after the 2020 golf tournaments were cancelled due to COVID-19. And branch members were thrilled to be back. Aside from a day of fun and socializing, albeit in a restricted manner this year, the CIM branch tournaments are excellent fundraisers.

This year marked the 89th edition of the CIM Montreal Branch golf tournament. It was held on September 2 at the Elm Ridge Golf Course in Île-Bizard, a suburb of Montreal. “This is our big event and we are happy to have it back after the one-year hiatus,” said branch president Jeffrey Cassoff. “We have members that have been coming to our golf tournament for many consecutive years. It is our only event that we aim for a positive cash flow.”

That positive cash flow – from 105 golfers, several generous sponsors and the CIM Foundation silent auction – goes towards student development, with the lion’s share to sponsoring the teams from McGill University and École Polytechnique at the Canadian Mining Games.

CIM Toronto Branch held its 20th annual CIM/CMP Frank Grieco Memorial Golf Tournament on August 25 at Glen Abbey Golf Club, which features a course designed by legendary golfer Jack Nicklaus. Van Vekris, the branch’s golf tournament lead, echoed Cassoff and said, “After 18 months of COVID-19, golfers were happy to be back on the course to socialize and network.”

Instead of the usual shotgun start, followed by an awards banquet, this year, the 123 Toronto branch golfers were split into two groups, the first started at 9:00 a.m. with players staggered every 12 minutes, followed by a lunch. The second group followed the same game plan, starting at 3:00 p.m. to prevent the

two groups overlapping. Gift certificate awards were emailed out to prize winners.

Funds raised will go towards educational events such as the branch’s monthly networking lunches, student mine-site tours and the annual Rocks and Stocks conference. “It’s important to encourage and attract folks to the industry,” said Vekris.

The CIM South Central B.C. Branch held its annual tournament at Kamloops Rivershore Golf Links on September 24, capping off the branch AGM and conference. At the time of writing, smog filled the skies from a month of wildfires burning in the south-central region. Hopefully, the fires will have died down for golfers to get out on the course for some much-needed camaraderie after an extra-long break.

“This year’s conference and golf tournament are important, as we did not have one in 2019 due to MEMO [CIM’s Maintenance, Engineering and Reliability / Mine Operators Conference], 2020 saw COVID and 2021 is seeing unprecedented wildfires in our area,” said branch co-chair Shawn Maunula. “We need to get together with our mining community more than ever.”

Recipients of funds from the 2021 conference and golf tournament will be the Kamloops Foodbank, as it is every year. “We will also be looking at helping out with those charities that have been supporting those affected by the wildfires. We did this in 2017 as well, when the northern part of the province saw evacuations,” said Maunula.

On September 10, the CIM Northern Gateway Branch will hold its 14th Annual Golf Classic. Like the other annual tournaments, along with most every kind of gathering, the 2020 one



Montreal branch golfers enjoy the annual kickoff breakfast a little differently this year, outdoors and socially distanced.

was cancelled due to COVID-19. The 2021 restrictions mean that only the first 100 registrants will be allowed in in order to respect the social distancing requirements at the dinner after the day on the links. At press time, those spots were filling up fast.

The importance of mining education is the focus of fundraising for Northern Gateway, with dollars raised going “to sponsor the Teacher’s Mining Tour, Mining Matters funding for local schools, Mining Week in North Bay, and others that we can sup-



CIM team at the Toronto Branch tournament. (From left) Van Vekris, Curtis Clarke, Kurt Breede and Anne Marie Toutant

port from our local branch coffers,” said Bernie Robertson, social program chair for the branch.

At the end of the day, the CIM branch golf tournaments are all about community, networking with fellow branch members and sponsors, giving back to local communities and outreach to the next generation mining community. “All of us have endured a very long winter, so we all look forward to spending a fun day outside,” said Vekris. “And it’s for a good cause.” **CIM**

CIM COUNCIL NOMINATIONS

are underway

▶ CIM First-Year Vice-President for Eastern – Quebec based (2022–2023)

▶ CIM First-Year Vice-President for Western (2022–2023)

Deadline: December 31, 2021



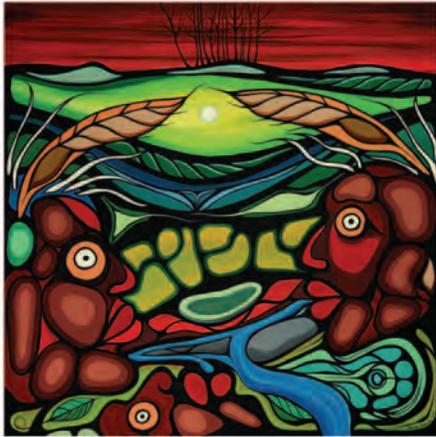
Submit nominations to Marilou Reboulis mreoulis@cim.org

District Vice-President by means of a letter signed by 25 members within that district. Notwithstanding provisions in CIM by-laws concerning nomination committees for vacant CIM Council positions.



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Par Tijana Mitrovic

Effectif de réserve

Le retour du *beer league hockey* (une ligue de hockey à portée sociale) constitue un développement très utile pour cette page du magazine. Après une saison interrompue en 2020-2021, laquelle n'aura duré que quelques semaines, nous avons reçu nos deux doses de vaccins et renouons maintenant les lacets de nos patins.

Le retour à la patinoire est l'occasion pour moi de revoir un ami qui travaille dans le secteur. Si sa formation technique n'était pas spécifiquement axée sur l'exploitation minière, les missions professionnelles de son bureau d'études techniques l'ont amené à participer à des projets au Québec ces dix dernières années.

Ce jour-là, il revenait de Val-d'Or juste à temps pour l'ouverture de la saison. Les dernières nouvelles qu'il me donnait dans le vestiaire sont venues ajouter un brin de couleur au ressenti collectif que j'entends souvent lors de réunions sur Zoom, à savoir que l'industrie est en manque d'effectif.

Même avant la pandémie et la hausse du prix de l'or, les conditions du marché du travail à Val-d'Or étaient déjà tendues. Aujourd'hui, me disait-il, la ville est plus animée que jamais, et reçoit davantage de personnes que les hôtels et restaurants ne peuvent accueillir. Ce printemps, le taux de chômage dans la région était tombé à 3,5 %.

D'après une présentation récente de Ryan Montpellier du conseil des ressources humaines de l'industrie minière (RHIM) au conseil de l'ICM, ce taux est équivalent à celui du secteur des ressources naturelles à l'échelle nationale. La génération du baby-boom prend sa retraite, les projets obtiennent des financements (notamment le projet d'exploitation de la potasse de Jansen de BHP, en page 11, uniquement disponible en anglais) et la réserve de travailleurs expérimentés s'assèche peu à peu.

« Une équipe éprouvée est indispensable pour un projet minier », écrit Ian Pierce dans sa rubrique intitulée *Five critical requirements for capital project success* (en page 24, uniquement disponible en anglais). Aujourd'hui cependant, les années d'expérience demandées dans nombre d'offres d'emploi ne sont que douces illusions. L'industrie connaît un déficit en ressources humaines (RH) et, toujours d'après la présentation du RHIM, cette tache venant assombrir les perspectives par ailleurs favorables pour l'industrie minière risque de perdurer. Les employeurs devront constituer des équipes de projets en composant avec les candidats qui semblent les plus prometteurs, et non pas en fonction de leur expérience éprouvée.

C'était le cas de mon ami. On le poursuivait pour un poste dans un projet minier pour lequel, me disait-il, il brûlerait quelques échelons dans son parcours professionnel.

Pour faire face à la pénurie en RH, un éventail de solutions se présente, parmi lesquelles la sensibilisation, l'engagement, le mentorat, la collaboration, les options stratégiques de perfectionnement professionnel et le partage des connaissances. Je souhaite de tout cœur, autant pour les employeurs que pour les employés propulsés dans de nouveaux postes que l'ingéniosité requise pour mener les projets à terme soit également prise en compte lors de la sélection et de l'orientation des équipes vouées à construire la prochaine génération de mines.

Cet enjeu sera inévitablement l'un des thèmes évoqués lors de notre *Capital Projects Symposium* (le symposium dédié aux projets d'investissement), qui aura lieu en novembre à Toronto.

Cet événement sera l'occasion de réunir des chefs de projets et des membres d'équipe potentiels à la recherche de l'expertise et du réseau nécessaires pour réduire l'écart qu'il existe entre leur niveau professionnel et le niveau que requiert l'industrie.

Organisé en ligne pour la première fois l'année dernière, le symposium s'est révélé être une excellente plateforme axée sur les enjeux et les stratégies d'exécution des projets. Cette année, l'établissement d'un réseau de relations en personne offrira une dimension bienvenue à cette expérience. C'est un complément appréciable à l'éventail d'événements organisés par l'ICM, et j'ai l'intention d'y prendre part, même si cela signifie que je ne pourrais pas chausser mes patins.

Ryan Bergen, Rédacteur en chef
editor@cim.org [@Ryan_CIM_Mag](https://twitter.com/Ryan_CIM_Mag)





Exploitions nos ressources

La vision stratégique de l'ICM est de faire de l'institut une autorité de confiance et une source collective d'évolution des connaissances, des lignes directrices et des meilleures pratiques pour l'industrie minière. À l'appui de cette vision, l'ICM se réjouit à l'idée d'organiser son second *Capital Projects Symposium* (le symposium dédié aux projets d'investissement), un événement annuel.

D'après l'une des statistiques souvent invoquées issues du rapport McKinsey de 2017, « quatre projets miniers sur cinq accusent des retards et des dépassements budgétaires de 43 % en moyenne ». Concernant la finalisation de projets qui respectent ou excèdent les objectifs économiques ou sociétaux fixés, on ne peut pas dire que les performances de notre industrie sont exceptionnelles.

La bonne nouvelle est qu'environ 20 % des projets respectent ces objectifs. Ils sont construits dans les temps et le budget accordés, arrivent rapidement à la phase de production, et atteignent les objectifs promis en termes de valeur actualisée nette

L'ICM réunit le savoir collectif nécessaire pour améliorer le taux de réussite des projets d'investissement

(VAN). Les preuves sont là, nous pouvons finaliser des projets conformément aux critères établis !

Pour les 80 % de projets restant, la question reste entière... Comment atteindre ces objectifs ? Cette question et ce sujet n'ont rien de nouveau. Dans son article fondateur de 1998, Terry McNulty nous présentait avec beaucoup de perspicacité les facteurs qui contribuent à la destruction de la VAN. Une recherche rapide sur Google vous mènera à une multitude d'articles et d'études qui ont tenté de quantifier les actions nécessaires à la finalisation des projets selon les critères impartis. On constatera que la plupart de ces études portent sur des aspects spécifiques du projet, particulièrement son exécution.

En définitive, les projets miniers sont complexes et requièrent la contribution et la collaboration de nombreux experts techniques, financiers et opérationnels à diverses étapes du développement du projet. Avec ses 11 sociétés techniques qui couvrent tous ces domaines d'expertise, l'ICM est bien placé pour pouvoir réunir le savoir collectif nécessaire et mettre en œuvre les meilleures pratiques requises pour améliorer le taux de réussite de nos projets, et par là même pour redorer le blason de notre industrie.

Nous devons réunir ces professionnels pour qu'ils partagent leur expérience et leurs connaissances. C'est pourquoi nous vous invitons à vous joindre à nous en novembre à Toronto, à l'occasion du second *Capital Projects Symposium*, le seul événement international annuel de l'industrie axé à 100 % sur les projets d'investissement.

Pierre Julien
président de l'ICM



Great Panther Mining a lancé dans son exploitation brésilienne le concours Safety Olympics. Tous les deux mois, l'équipe gagnante remporte le trophée Gold Hat et, à la fin de l'année, les grands gagnants reçoivent 100 000 réaux brésiliens (l'équivalent de 17 500 dollars) pour le financement d'initiatives relatives à la sécurité, que l'équipe peut investir comme bon lui semble.

Mettre la sécurité en pratique

Les écarts culturels et la complaisance contribuent aux problèmes de sécurité dans les mines

Par Rosalind Stefanac

Aujourd'hui plus que jamais, les sociétés minières de tous bords s'efforcent d'améliorer les protocoles de sécurité, dans l'objectif d'éliminer toute blessure ou accident mortel avec perte du temps de travail. Dans cette optique, les sociétés minières ont investi dans des formations supplémentaires en matière de sécurité et dans des évaluations de la gestion des risques, tout en adoptant des mesures de rendement en matière de sécurité qui récompensent les accomplissements et visent à normaliser les pratiques exemplaires.

Malgré une baisse considérable des taux de fréquence des blessures, et une diminution constante des décès dans les mines, des incidents prenant une tournure tragique continuent d'entraîner la mort de mineurs chaque année dans des sociétés minières canadiennes. D'après les données fournies par l'association des commissions des accidents du travail du Canada (ACATC), 30 personnes travaillant dans l'industrie minière canadienne sont décédées sur leur lieu de travail en 2019, et 53 personnes en 2018. Il n'est donc pas surprenant de constater que le rendement du Canada en matière de sécurité est encore moyen à l'échelle mondiale. C'est ce que constate un expert en sécurité, Corrie Pitzer, président et directeur général de Safemap International, une société de Vancouver spécialisée dans la transformation et la gestion stratégique de la sécurité, qui propose ses consultations à des sociétés minières du Canada et du

monde entier. Il a tiré cette conclusion sur la base de ses expériences dans l'industrie et de ses interactions avec des sociétés minières. Par ailleurs, fait-il remarquer, si de nombreuses sociétés canadiennes s'efforcent d'améliorer leurs indicateurs de rendement en matière de santé et de sécurité et sont largement en avance par rapport à d'autres en termes d'approche et de pratiques, beaucoup de sociétés minières accusent encore l'équivalent d'une décennie de retard dans ce domaine.

« Dans certains domaines du secteur minier, on considère que si les contrôles suffisants existent et que les employés les respectent, il ne devrait pas y avoir de problème. La réalité est malheureusement bien plus complexe », déclarait-il. « Nombre de catastrophes se produisent même lorsque les gens respectent les procédures. C'est le degré de préparation des employés pour faire face au risque et se concentrer sur le risque qui fait la différence entre certaines organisations canadiennes et d'autres, à la pointe dans ce domaine. »

Mike Parent, vice-président des services à Sécurité au travail dans le Nord (STN), lui-même ancien mineur de fond, expliquait qu'il lui a fallu des années pour vraiment jauger le nombre de risques auxquels sont exposés les mineurs de fond quotidiennement, et ce, alors même qu'il travaillait dans une organisation très rigoureuse et bénéficiait d'une orientation complète sur son lieu de travail. « Les risques sont multiples. Par exemple, des

chutes de roches et des machines peuvent nous écraser, des choses invisibles à l'œil nu peuvent nous empoisonner », indiquait-il. « Des risques majeurs peuvent aussi se développer dans une zone de la mine dont personne n'est conscient. » Il peut s'agir, par exemple, d'une accumulation d'eau souterraine pouvant entraîner une coulée de matériaux de déblai qui pourrait tout écraser sur son passage.

Pour identifier les principaux risques dans les mines souterraines et déterminer les causes fondamentales et les contrôles nécessaires afin d'éviter de futurs accidents de se produire, le gouvernement de l'Ontario, en collaboration avec l'industrie minière de l'Ontario, a lancé une étude approfondie en 2014 qui, selon M. Parent, oriente le Canada dans la bonne direction. Le rapport final identifiait six domaines importants, à savoir les risques en matière de santé et de sécurité, les nouvelles technologies, la préparation aux situations d'urgence et le sauvetage dans les mines, les enjeux liés à la formation, à la compétence et à la main-d'œuvre, et les systèmes de responsabilité interne (SRI). Ce rapport fournissait 18 recommandations, en cours de mise en œuvre par le gouvernement et d'autres parties prenantes de l'industrie pour réduire les risques professionnels. Le ministère du travail de l'Ontario a également organisé un atelier dédié à l'évaluation des risques dans le secteur des mines à ciel ouvert en 2016, et publié un résumé des résultats de son étude.

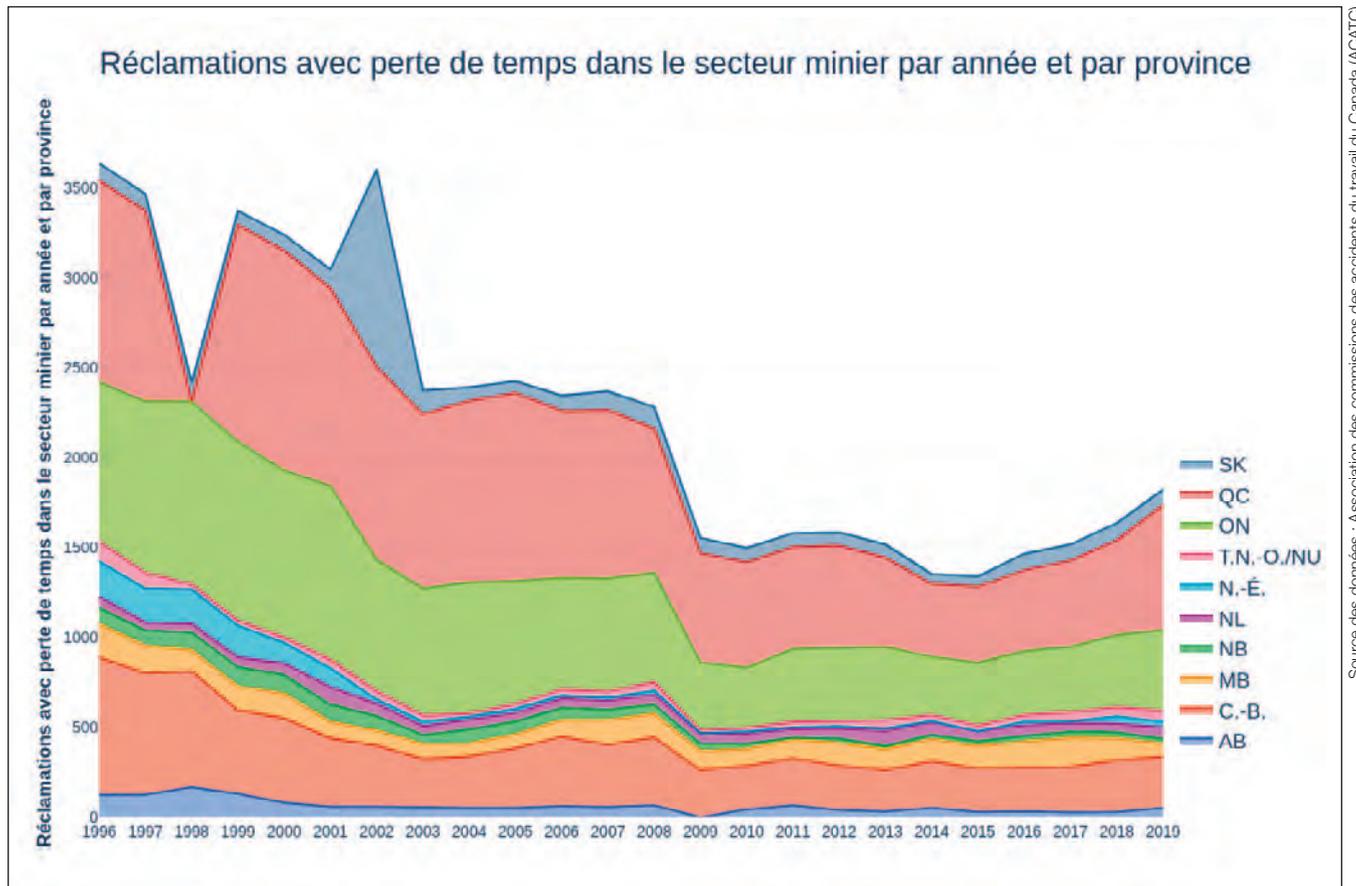
« Mieux vaut prévenir que guérir. Il est préférable de comprendre d'où peuvent émaner les échecs potentiels et quels contrôles probables doivent être mis en place plutôt que de devoir étudier la situation sur la base des accidents », indiquait M. Parent. « À l'avenir, on doit s'intéresser aux risques majeurs

et s'assurer que des contrôles efficaces sont en place pour protéger [les employés]. » Le numéro un des risques identifiés dans l'évaluation des risques dans les mines souterraines concerne le contrôle des pressions de terrains (secousses, chutes de roches sous terre), suivi de l'équipement mobile impliquant de petits ou gros véhicules et des piétons.

Pour réduire les risques en matière de sécurité, la culture est essentielle

M. Parent indiquait que la déconnexion au niveau de la culture de l'entreprise constitue un autre problème empêchant le secteur minier canadien d'améliorer ses résultats dans le domaine de la sécurité. Après avoir mené une étude pilote sur un outil de vérification des SRI (un concept qui a fait son chemin depuis l'étude initiale de 2014) dans six mines de l'Ontario, M. Parent et son équipe ont constaté que les mines affichant le plus mauvais rendement en matière de sécurité d'application présentaient également le plus grand écart de perception entre les travailleurs et les dirigeants en termes de ce qui fonctionnait ou pas. « Nous avons fini par comprendre que les employés aiment participer et souhaitent voir des dirigeants qui sont réellement présents et comprennent ce qu'il se passe dans l'exploitation », indiquait-il. « Par expérience, lorsque les dirigeants sont réellement à l'écoute de ce qu'il se passe, ils sont mieux à même de faire face aux réalités du lieu de travail. Ces exploitations sont généralement les plus performantes. »

Pour Great Panther Mining, une société productrice d'or et d'argent ayant des actifs au Mexique, au Brésil et au Pérou, gérer les questions de culture implique de remédier à l'absence



de dialogue et d'informations entre la direction et les travailleurs de terrain, mais aussi de personnaliser les messages liés à la sécurité afin d'atteindre les cultures des différents lieux de travail dans ce domaine. D'après le directeur de l'exploitation de la société, Fernando Cornejo, l'équipe de direction doit bien comprendre les particularités culturelles du pays et adapter les messages en fonction si elle cherche à promouvoir des changements qui amélioreront le comportement qu'il convient d'adopter pour garantir la sécurité. « Dans notre cas, la culture brésilienne est très différente de la mexicaine. Ainsi, l'approche adoptée pour faire comprendre aux [travailleurs] ce que l'on essaie d'appliquer en matière de sécurité changera en fonction du pays », indiquait-il. Par exemple, au Mexique, l'objectif est de responsabiliser les employés et de les inciter à s'exprimer s'ils considèrent que les conditions dans lesquelles ils travaillent sont peu sûres. Au Brésil, où les employés sont plus véhéments, l'objectif est d'aligner cette énergie sur l'évaluation des risques à l'aide d'outils dédiés à la sécurité.

En 2020, Great Panther a lancé au Brésil le programme *Safety Olympics*, un concours qui promeut, entre autres, la sensibilisation des employés à la sécurité (il sera élargi à ses autres exploitations). Ce programme accorde des points pour l'utilisation d'outils dédiés à la sécurité et récompense les groupes qui obtiennent les plus hauts scores. Les groupes réalisant les meilleurs scores remportent une prime en espèces qu'ils peuvent investir dans leur propre lieu de travail et site, comme bon leur semble. La société encourage également chacune des mines à nommer trois candidats pour son *Kenneth W. Major Award for Safety Excellence* (le prix annuel Kenneth W. Major pour l'excellence en matière de sécurité). Ancien directeur de la société, M. Major était un fervent défenseur de la sécurité. Il est décédé en 2018.

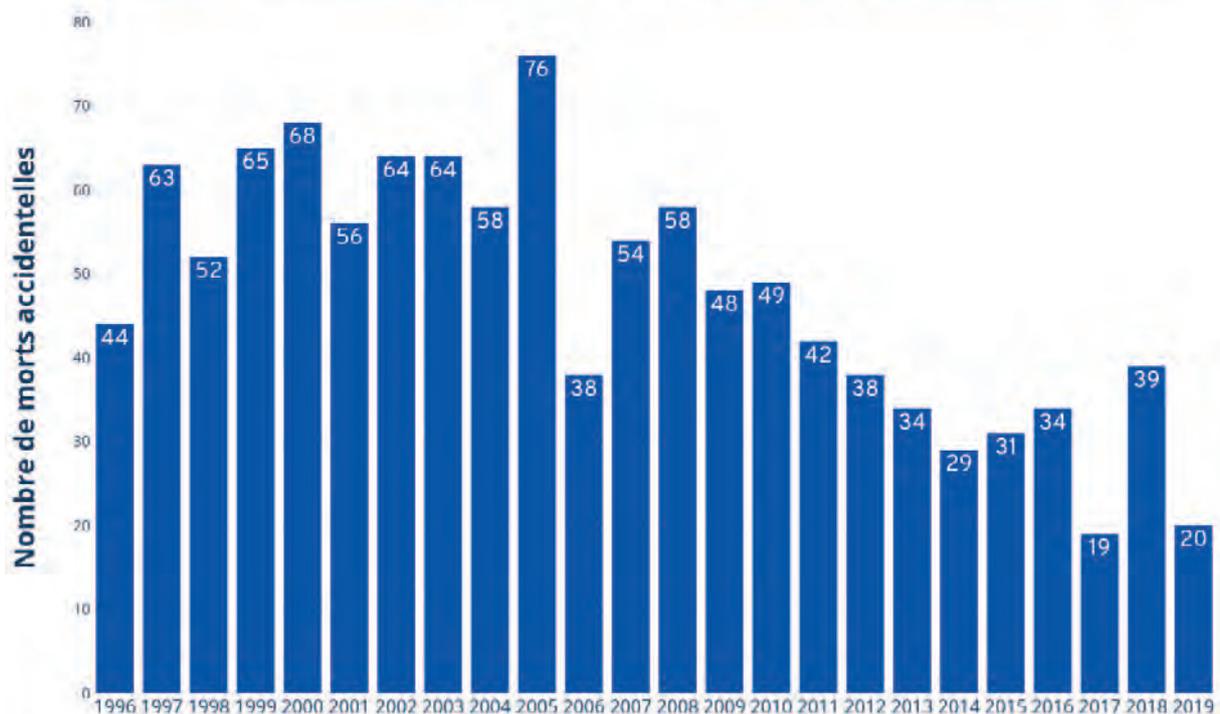
« L'évolution des dirigeants dans l'industrie minière implique en partie d'admettre que rien ne sert de punir. [Mieux vaut] récompenser les employés et leur offrir des motivations, de manière à les encourager à agir dans ce sens », expliquait M. Cornejo. « La reconnaissance a un fort impact sur les employés. »

Créer une atmosphère où les employés sur le terrain se respectent les uns les autres est un élément puissant dans le développement d'une culture de la sécurité. Maura Kolb, directrice de l'exploration à Treasury Metals, dirige des équipes d'exploration depuis 10 ans. « Si l'on pense aux personnes avec lesquelles on travaille, si on les respecte et on fait attention les uns aux autres, ce niveau d'attention fait des merveilles et le système de réponse interne fonctionne bien », indiquait-elle. « On a arrêté de se demander pourquoi l'on se préoccupe de la sécurité alors que l'on devrait en faire une simple case à cocher. »

À son poste actuel, elle a développé, aux côtés de son équipe, 14 stratégies qui fonctionnent bien pour modérer les erreurs qui peuvent aboutir à des blessures dans le travail sur le terrain en cours dans le nord-ouest de l'Ontario. En planifiant les tâches et en organisant des rassemblements tous les matins, par exemple, elle s'assure que les membres de l'équipe ont une idée précise de ce qui doit être fait chaque fois qu'ils vont sur le terrain. « J'essaie aussi de participer aux rassemblements en petits groupes chaque matin et aux inspections de terrain sur le site », indiquait-elle. « Les blessures arrivent lorsqu'on est occupé(e) et que l'on manque de rigueur. La communication constante nous aide réellement à ne pas en arriver là. »

L'anticipation afin d'éviter les risques sur le terrain fait également toujours partie des priorités de la société. Au vu des feux de forêts qui se sont déclenchés cet été près des sites d'exploration, son groupe a engagé une réunion avec le ministère du

Morts accidentelles dans le secteur minier à l'échelle nationale



Source des données : Association des commissions des accidents du travail du Canada (ACATC)

développement du Nord, des mines, des richesses naturelles et des forêts de l'Ontario. « Des [représentants] du ministère sont venus sur le site pour effectuer un examen [unique] des pratiques que nous avons mises en place avec nos entrepreneurs en forage pour atténuer le risque de déclencher un feu lors d'une activité de forage », indiquait-elle.

M^{me} Kolb expliquait qu'il peut être bénéfique que d'autres personnes voient les choses sur le terrain de temps à autre, car elles perçoivent des risques potentiels que l'équipe peut ne pas remarquer. Elle inspecte elle-même d'autres lieux de travail, ce qui l'aide à discerner les zones de risques sur son propre site, que l'équipe pourrait avoir sous-estimées.

Pour atteindre une atmosphère de sécurité totale, chaque employé(e) doit être conscient(e) de sa propre sécurité et de celle de ses partenaires sur le terrain. « Ce n'est pas nécessairement à la ou au responsable de suggérer un changement. Tout le monde peut le faire », déclarait-elle. « Sur le plan de la sécurité, nous sommes tous égaux, et c'est la culture que doit adopter notre industrie. »

Éliminer le « secret entourant les risques »

D'après M. Pitzer, pour renforcer la sécurité de l'exploitation minière de manière générale, l'industrie doit réduire l'importance qu'elle accorde aux résultats en termes de rendement et à l'élimination totale des taux de blessures ou d'accidents entraînant des pertes de temps. « Même sans blessure ou accident, les catastrophes [peuvent tout de même] arriver quelques secondes plus tard », indiquait-il.

De fait, c'est en travaillant avec des chefs de file de l'industrie dont les taux de blessures entraînant des pertes de temps étaient

excellents qu'il a observé des niveaux croissants de « risques gardés secrets » se frayant un chemin dans les attitudes des sociétés envers la sécurité. « Les gens hésitent de plus en plus à chambouler leurs projets lorsqu'une société fonctionne bien. Ceci met une pression considérable sur les employés, surtout sur ceux en première ligne », ajoutait-il. « Nous avons découvert des risques mortels importants dont les employés refusaient de parler par peur d'avoir à transmettre des mauvaises nouvelles. »

En définissant la « sécurité » comme la volonté de faire face à un risque, les sociétés développent une culture qui, à terme, protégera ses employés, expliquait M. Pitzer. Ceci implique de trouver le bon équilibre entre les stratégies de sécurité et la découverte, l'analyse et le contrôle des risques. Dans ce contexte, les superviseurs au niveau opérationnel doivent être formés « à encourager et à inviter les personnes à exprimer » leurs préoccupations. « La responsabilité ne se limite pas au respect des règles. Les employés doivent bien comprendre qu'ils ont l'obligation d'arrêter de travailler si leurs activités deviennent dangereuses. » **ICM**

Mike Parent et Corrie Pitzer se sont exprimés à l'occasion du CIMVTL21. Vous pouvez accéder à leurs présentations (et aux autres du congrès) sur le site Internet de l'académie de l'ICM : <https://academy.cim.org>.

Pour consulter les évaluations des risques en matière de santé et de sécurité dans le secteur minier, et les analyses des causes fondamentales émanant de l'étude de 2014, rendez-vous sur le site Internet de Sécurité au travail dans le Nord : <https://www.workplacesafetynorth.ca/industries/mining>

L'ICM lance un APPEL DE CANDIDATURES

➔ Vice-président de District de première année de l'Est – Basé au Québec (2022–2023)

➔ Vice-président de District de première année de l'Ouest (2022–2023)

Échéance : 31 décembre 2021



Prière de faire parvenir les propositions de candidatures à Marilou Reboulis mreboulis@cim.org



Une proposition de candidat au poste de vice-président de district peut être soumise par le biais d'une lettre signée par 25 membres du dit district. Nonobstant les règlements de l'ICM portant sur les comités de nominations pour les postes vacants au sein du Conseil.



Misabi, par James Faubert de la Première Nation de Temagami

Mise en application des principes

La codification de la DNUDPA en une loi canadienne n'est que le début. Reste à comprendre comment l'appliquer et comment assurer la participation des parties prenantes autochtones à des consultations constructives

Par Tijana Mitrovic

D*enendeh* signifie la terre des peuples dénés. Cette région d'un million de kilomètres carrés (km²) est située dans la partie ouest des Territoires du Nord-Ouest (T.N.-O.), principalement au sud de la limite forestière. C'est un territoire que la nation dénée souhaite protéger et administrer. C'est également une région riche en ressources minérales.

« Notre région renferme de l'or, des diamants, du minerai de fer, toutes sortes de minéraux. Les peuples autochtones veulent être impliqués dans l'intégralité du processus minier », déclarait le chef national déné Norman Yakeleya.

Cette région a aussi beaucoup souffert de l'exploitation minière. Les Dénés vivent dans l'ombre de l'ancienne mine d'or Giant et des 237 000 tonnes de poussière de trioxyde de diarsenic qu'elle a laissées derrière elle.

« Nous avons subi l'implantation de la mine Giant qui n'a tenu compte ni des Dénés ni de *Denendeh*, et regardez où nous en sommes aujourd'hui. Nos communautés sont dévastées. Les citoyens de *Denendeh* ont le cœur gros quand ils en parlent, et [ils ont juré] de se battre aussi longtemps qu'il le faudra pour assainir le site de la mine Giant. »

La voie à adopter pour gérer les anciens sites miniers et participer aux nouveaux projets semble désormais plus claire pour les Dénés et les autres peuples autochtones du Canada. En 2007, le Canada faisait partie des quatre États membres de l'Organisation des Nations Unies (aux côtés de la Nouvelle-Zélande, des États-Unis et de l'Australie) qui refusaient l'adoption de la déclaration des Nations Unies sur les droits des peuples autochtones (DNUDPA). Cet été, le Canada est revenu sur sa position et a accepté de codifier la DNUDPA en une loi fédérale. Le gouvernement du Canada et le gouvernement des T.N.-O. suivent la trace du gouvernement de la Colombie-Britannique, qui a adopté la DNUDPA fin 2019.

Il reste encore beaucoup à faire concernant les spécificités de sa mise en application et les répercussions à long terme. Cela s'explique notamment par la nature de la DNUDPA qui, plus qu'une simple liste de vérification de ce qu'il faut ou ne faut pas faire, constitue davantage un cadre de référence en regard duquel les futures lois seront créées et les lois existantes seront harmonisées. La DNUDPA renforcera cependant le droit garanti par la Constitution selon lequel les gouvernements devront procéder à

une consultation exhaustive avec les peuples autochtones, notamment en ce qui concerne l'extraction des ressources sur les terres traditionnelles.

En vertu de la DNUDPA, il incombe au gouvernement d'organiser cette consultation avec les peuples autochtones, même s'il élude parfois cette responsabilité. Pour les sociétés d'exploration et d'exploitation minières qui prennent la consultation très au sérieux et ont entamé des négociations en toute bonne foi avec les propriétaires terriens, il y aura peu de changements. Pour d'autres, cependant, l'adoption de la DNUDPA pourrait marquer la fin définitive de certaines manières de mener leurs activités. De fait, les peuples autochtones exigeront désormais de se trouver à la table des négociations avant que tout nouveau projet minier ayant une incidence sur leur communauté ne puisse être lancé.

« Je suis fermement convaincu que l'application de la déclaration revêt une portée symbolique importante, signifiant l'engagement des gouvernements fédéral et territoriaux non pas à régir les gouvernements autochtones, mais plutôt à gouverner à leurs côtés », déclarait le chef Yakeleya. « C'est une étape dans la bonne direction pour corriger les erreurs du passé. »

Adoption et promulgation

En juin, le gouvernement fédéral a promulgué le projet de loi C-15 (qui a été renommé *loi sur la déclaration des Nations Unies sur les droits des peuples autochtones* après avoir reçu la sanction royale), introduisant le cadre de la DNUDPA dans la loi canadienne.

La déclaration comprend 46 articles qui considèrent les droits fondamentaux dont doivent jouir les peuples autochtones ainsi que leurs droits à l'autodétermination. Plus spécifiquement, elle précise que les gouvernements doivent consulter les peuples autochtones « avant l'approbation de tout projet ayant des incidences sur leurs terres ou territoires et autres ressources, notamment en ce qui concerne la mise en valeur, l'utilisation ou l'exploitation des ressources minérales, hydriques ou autres ».

En novembre 2019, le gouvernement provincial de la Colombie-Britannique adoptait à l'unanimité le projet de loi 41, également appelé « loi concernant la déclaration des Nations Unies sur les droits des peuples autochtones » (DRIPA, de l'anglais *Declaration on the Rights of Indigenous Peoples Act*). Si cette loi récemment adoptée donne mandat à chaque ministère du gouvernement d'élaborer un plan d'action et de rendre compte chaque année de ses progrès quant au respect des articles de la DNUDPA, la pandémie de COVID-19 a entravé sa promulgation jusqu'à récemment. Le gouvernement provincial n'a publié son projet de plan d'action qu'en juin 2021, et a invité les peuples autochtones à envoyer leurs commentaires.

D'après Merle Alexander, spécialiste en droit des ressources autochtones et directeur du groupe de droit autochtone au cabinet d'avocats Miller Titerle + Company de Vancouver, l'application de la DNUDPA est une tâche considérable. M. Alexander est membre et chef héréditaire de la Première Nation des Kitasoo Xai'xais en Colombie-Britannique. Il faisait partie d'une équipe de corédaction de la DRIPA et représentait la Colombie-Britannique pendant l'engagement national du gouvernement fédéral sur le projet de loi C-15.

« [Ce] que nous avons constaté en Colombie-Britannique... est que la condition à remplir pour harmoniser les lois [avec la DRIPA] est réellement [considérable] et implique de véritable-

ment changer la manière dont on élabore généralement les lois », expliquait-il. « À défaut de faire tout le travail et de créer des mécanismes adaptés pour y parvenir, on risque de se retrouver hors jeu presque immédiatement dès la première session législative. »

Outre l'importance d'un effort concerté, il faut accorder une grande place à l'éducation, indiquait Sharon Singh, avocate et associée au cabinet d'avocats Bennett Jones LLP. M^{me} Singh siège au conseil consultatif de la communauté Wet'suwet'en et est conseillère supérieure de direction au sein de la *Mining Association of British Columbia* (MABC, l'association minière de Colombie-Britannique). « Lorsque la DRIPA est entrée en vigueur, le ciel ne s'est pas écroulé sur la Colombie-Britannique... une pause perceptible a cependant été marquée à certains niveaux du processus décisionnel gouvernemental... [et] la confusion régnait entre les représentants publics quant à ce que la DRIPA avait ou non accompli », expliquait-elle. « Malgré le plan de communication instauré par le gouvernement expliquant qu'il s'agissait d'une loi-cadre requérant des étapes supplémentaires pour la mise en œuvre de certains éléments... la formation en interne était insuffisante, [ce qui], inévitablement, a engendré des retards supplémentaires et des attentes mal gérées. »

Malgré l'incertitude, M^{me} Singh précisait que l'industrie minière a été parmi les premiers secteurs à établir des partenariats avec les peuples autochtones. De fait, les sociétés minières travaillent depuis longtemps sur les territoires des nations autochtones. « Les sociétés minières sont totalement conscientes du fait que les peuples autochtones sont détenteurs de droits et les nations autochtones détentrices de titres, ce concept n'avait donc rien de nouveau. Essentiellement, l'industrie fait preuve de beaucoup de bon sens et a ouvert la voie. »

À la recherche des connaissances locales

À Red Chris, l'évolution du projet jusqu'au stade de la production était un effort en collaboration entre les exploitants de la société et les communautés autochtones locales. Située au nord-ouest de la Colombie-Britannique, l'exploitation à ciel ouvert d'or et de cuivre de Red Chris a atteint la phase de production en 2015.

Peu de temps après avoir acheté sa part de 70 % à la mine de Red Chris en août 2019, Newcrest Mining a signé une entente exhaustive sur les répercussions, les avantages et la cogestion (IBCA, de l'anglais *Impact, Benefit and Co-management Agreement*) entre Newcrest, le gouvernement central Tahltan (TCG), la bande Iskut et la bande des Tahltans. Cette entente constitue la base d'un partenariat entre les parties pour toute la durée de vie de la mine.

« Travailler avec des groupes autochtones ne consiste pas uniquement à manifester un intérêt de pure forme pour les groupes locaux lorsqu'ils sont présents », déclarait un porte-parole de Newcrest. « Nous avons commencé par demander conseil aux experts, internes et externes, qui connaissent le contexte local, et à accorder une grande attention au contexte social. »

La société a commencé à soutenir le développement commercial au sein du territoire Tahltan dans le cadre de la mise en œuvre de l'IBCA, notamment en assurant la formation des membres de la communauté des Tahltans pour des emplois dans le domaine des études techniques et de la production, ainsi qu'en créant des partenariats avec des entreprises de la communauté

des Tahltans telles que Tahltan Forestry pour les services de diagraphie. Newcrest utilise aussi son système de gestion du patrimoine culturel (une série de sondages et de programmes d'évaluation dédiés au patrimoine culturel) pour tous ses sites. En pratique, cela implique de collaborer avec les préposés aux relations communautaires, avec des archéologues et des anthropologistes professionnels qualifiés ainsi qu'avec les représentants des propriétaires terriens afin d'identifier les sites s'inscrivant dans le patrimoine culturel et de les préserver.

« L'orientation et les contributions continues des Tahltans sont indispensables pour concevoir des approches d'engagement sérieuses », indiquait le porte-parole de Newcrest. « Un engagement sérieux nous garantit que l'exploitation intègre les points de vue, les préoccupations et le savoir de la nation des Tahltans. »

Ce niveau d'engagement peut aussi avoir un effet positif sur la durabilité d'une société, expliquait M^{me} Singh. « L'engagement envers les Autochtones constitue un aspect majeur de la performance environnementale, sociale et de gouvernance (ESG) d'une société. Il représente une part primordiale de la performance sociale et de la gouvernance », ajoutait-elle. « C'est l'un des [éléments] qui recoupe tous les piliers de l'ESG, et la DNUDPA en fait partie intégrante. Désormais, lorsque les sociétés minières arriveront dans une communauté, on leur demandera si elles adhèrent à la DNUDPA et en quoi elles y contribuent. »

La consultation promeut également la conciliation. « Les Autochtones doivent faire partie des discussions, du début à la fin », expliquait le chef Yakeleya. « Il est essentiel d'entretenir une collaboration et un dialogue respectueux durant toutes les étapes des projets d'exploitation minière et d'extraction des ressources. Nous voulons être traités sur un pied d'égalité et comme des partenaires respectés, et souhaitons avoir une place dans l'industrie minière. Pour nous, cela fait partie de la stratégie de conciliation. Il est important de créer des ententes sur les répercussions et les avantages (ERA) et de partager les revenus issus des impôts sur les ressources minérales. »

De la consultation au codéveloppement

Pour Michelle Tanguay, responsable de la durabilité et des relations communautaires à Northisle Copper and Gold, le codéveloppement d'un projet est essentiel pour bâtir des relations entre les sociétés minières et les groupes autochtones. « Cela annonce une coopération sur un pied d'égalité, garantit que toutes les communications sont replacées dans le bon contexte, et confirme que tout le monde partage une vision commune, que les problèmes sont abordés ouvertement dès le départ », expliquait-elle. « C'est un peu comme une langue commune, une vision commune. »

Northisle Copper and Gold détient le projet de porphyre aurifère-cuprifère de North Island, situé près de Port Hardy, en Colombie-Britannique. La société a récemment finalisé la nouvelle version de son évaluation économique préliminaire (ÉÉP), et travaille maintenant sur une étude de pré faisabilité. L'une des priorités de M^{me} Tanguay consistera à mener des activités d'information de la communauté auprès des détenteurs de droits locaux.

« Du point de vue de notre société, nous voulons fixer un délai raisonnable... et obtenir le consentement libre, préalable et éclairé pour tout ce que nous envoyons en vue d'obtenir une autorisation », indiquait-elle. « Il faut faire très attention et mettre en balance ces éléments afin de respecter les délais. Il est très difficile d'envoyer la demande car cela peut prendre jusqu'à

une année en Colombie-Britannique, mais il faut aussi s'être entretenu au préalable avec la nation. »

En ce qui concerne le consentement libre, préalable et éclairé, M^{me} Tanguay est d'avis que la meilleure des approches à adopter est que les sociétés minières s'engagent dès que possible. « Il faut réellement se pencher sur le consentement éclairé [plus tôt] pour mieux comprendre le contexte plus vaste de ce que l'on propose », expliquait-elle. « L'impartialité, l'honnêteté, la transparence et la communication font réellement partie de cet élément. La nation développe ensuite des processus, et nous nous assurons de faire notre possible pour la soutenir. »

En route vers « une nouvelle manière de travailler »

Les sociétés minières sont curieuses de voir comment sera interprétée la loi de la DNUDPA dans la loi canadienne, une fois qu'elle sera promulguée. On parle déjà du manque de clarté entourant les réformes juridiques potentielles du droit concernant les activités de consultation sur la réglementation.

« La loi pourrait engendrer une plus grande certitude juridique, permettant de connaître les règles entourant des questions sensibles telles que le consentement libre, préalable et éclairé. En revanche, si le gouvernement fédéral ne l'applique pas et emploie très peu de ressources, elle pourrait simplement jeter de l'huile sur le feu », déclarait le chef héréditaire Alexander.

Mais alors, quelle est la solution ? D'après Tara Shea, directrice principale de la réglementation et des affaires autochtones à l'association minière du Canada (AMC), le gouvernement doit administrer une orientation, une formation et des politiques renforcées pour s'assurer que les représentants fédéraux disposent des outils nécessaires pour s'engager sérieusement dans des activités de consultation sur la réglementation avec les communautés autochtones, tel que l'impose l'obligation de la Couronne. « L'application défectueuse de cette loi, et notamment l'incapacité à offrir une meilleure orientation concernant les procédures de participation des Autochtones à des projets et à déterminer si des changements aux procédures existantes sont envisagés, pourrait détériorer les relations entre les partisans du secteur minier et les communautés autochtones, entraînant des tensions au niveau du projet. »

Comme l'expliquait M^{me} Shea, cette loi ne constituera pas de changement majeur en pratique en termes d'engagement envers les communautés autochtones et de collaboration avec elles, tout du moins pas pour les sociétés minières qui se conforment au protocole Vers le développement minier durable (VDMD) de l'AMC, lequel a été rédigé en ayant à l'esprit la DNUDPA. « Les sociétés minières ouvrent la voie en termes de création de partenariats avec des entreprises autochtones. De fait, nombre de sociétés minières investissent des millions de dollars chaque année dans des contrats avec des prestataires de service autochtones », indiquait-elle.

Toutefois, ajoutait-elle, le gouvernement devra gérer les attentes concernant tout changement nécessaire à venir pour harmoniser les lois avec les objectifs de cette nouvelle loi. « Je ne pense pas que ce message ait été pleinement communiqué, pas seulement aux peuples ou aux nations autochtones en toutes lettres, mais également au public et même aux partisans et à l'industrie », indiquait M^{me} Singh. « Cela signifie que les attentes mal gérées se poursuivent, lesquelles s'accompagnent de déception ou de confusion. Et ceci aboutit à l'incertitude. »

Malgré cette ambiguïté, les sociétés peuvent tout de même réfléchir au style de leur consultation et prévoir les change-

ments qu'elles devront apporter à leurs processus afin qu'elles adhèrent aux réformes futures, conformément aux articles de la DNUDPA. « [Les partisans] qui aspirent réellement à une certitude pour les projets qu'ils prévoient d'exploiter au cours des cinq à cinquante prochaines années auront tout à gagner à négocier des ententes progressives permettant des adaptations à la loi, ou à disposer de mécanismes au sein de leurs ERA leur permettant d'adapter les changements matériels à la loi », expliquait le chef héréditaire Alexander. « Peu importe où arrivera la loi en termes de réforme du droit minier, elles auront une longueur d'avance. »

Aller plus loin

Que peuvent faire les sociétés qui souhaitent prendre une longueur d'avance sur la DNUDPA ? D'après M^{me} Singh, les sociétés minières devraient aller au-delà des pratiques habituelles et envisager l'engagement comme une approche de partenariat avec la communauté.

« Tout le monde sait que si les nations sont de notre côté et que l'on bénéficie de leur soutien, le projet sera très probablement plus facile à développer », indiquait-elle. « De plus en plus, il n'est plus question de ce qui est acceptable, mais de ce que l'on peut faire... pour permettre à la nation de prospérer. »

La participation des peuples autochtones doit perdurer pendant toute la durée de vie de la mine. Planifier la remise en état de la mine à l'avance est une manière de s'assurer que l'engagement envers les Autochtones se poursuit au-delà de l'approbation du projet et jusqu'à son développement. « Trop de mines sont abandonnées et doivent être remises en état », déplorait le chef Yakeleya. « Les sociétés minières devraient collaborer avec les gouvernements autochtones pour s'assurer qu'elles assainissent les terres et les remettent dans l'état où elles les ont trouvées initialement, lorsqu'elles ont commencé à y travailler. »

Consentement libre, préalable et éclairé

L'article 32 est sans doute le plus controversé de la DNUDPA. Il donne « le droit aux peuples autochtones de définir et d'établir des priorités et des stratégies pour la mise en valeur et l'utilisation de leurs terres ou territoires et autres ressources » et établit qu'ils devront donner leur « consentement, librement et en connaissance de cause » avant l'approbation de tout projet ayant des incidences sur leurs terres. Les détracteurs de cette loi prétendent que cela accorde un « droit de veto » aux peuples autochtones quant aux projets d'exploitation des ressources naturelles. Si le consentement libre, préalable et éclairé n'est pas défini par la DNUDPA ou par la loi, « la DNUDPA est plus ou moins une affirmation des droits existants », expliquait le chef héréditaire Alexander. « Il ne crée pas de droits en lui-même. »

Les sociétés minières doivent donc envisager le consentement sur la base du cas par cas, car chaque projet et relation avec une partie prenante autochtone sont différents. « Mettre le consentement libre, préalable et éclairé en pratique n'implique pas d'adopter une approche unique », indiquait le porte-parole de Newcrest. « Nous intégrons l'engagement précoce dans tous les aspects de nos projets et visons à [incorporer] les résultats de cet engagement continu dans la conception et les approches du projet. Cela inclut le développement d'approches mutuellement acceptables envers l'enga-

gement et la consultation avec les communautés et les groupes autochtones, axées sur des résultats de nos exploitations bénéfiques pour les deux parties. »

Le consentement est davantage une obligation de consulter ou une approche réactive lorsqu'un conflit émerge. Il est évolutif, dynamique et actif durant tout le développement de la mine, indiquait le chef héréditaire Alexander. « Dans l'ensemble, les gens s'en inquiètent beaucoup car ils envisagent le consentement comme un processus trop statique, alors qu'il s'agit d'un processus dynamique dans lequel le consentement doit être maintenu », ajoutait-il. « Ce sont nos actions, le niveau de partage d'informations et la confiance mutuelle qui maintiennent le consentement. »

Si la consultation peut parfois être une pratique tendue, c'est en s'asseyant autour d'une table que les parties se comprennent. « Pour moi, cela signifie que les sociétés doivent venir à nous et nous parler », expliquait le chef Yakeleya. « Quoi qu'elles fassent, quoi qu'elles décident de nous présenter, elles devront venir s'asseoir avec les propriétaires terriens. Elles devront s'asseoir avec les chefs, avec la communauté, et nous parler, nous écouter et bien entendre ce que nous avons à leur dire. Elles devront être attentives à nos préoccupations, écouter ce que l'on veut voir mentionné dans les ententes, entendre les vœux de notre communauté et bien comprendre ce qu'implique le développement de leurs projets sur nos terres. »

Parfois, la consultation pourra mener les projets dans une voie différente.

En avril, Skeena Resources a renvoyé ses revendications concernant le gisement Spectrum, près du parc provincial de Mount Edziza, à la nation des Tahltans en Colombie-Britannique. Après les consultations avec les Tahltans, la société a pris conscience de l'importance écologique et culturelle des terres pour la nation des Tahltans. Par la suite, la nation des Tahltans a investi 3,9 millions de dollars dans Eskay Creek, et la société a collaboré avec le TCG, la province de la Colombie-Britannique, Conservation de la nature Canada (CNC) et la *BC Parks Foundation* (la fondation des parcs de la Colombie-Britannique) pour créer une zone de 3 500 hectares de conservation de la nature.

Une certaine confusion persiste quant à la façon dont les réglementations guidées par la DNUDPA rendront le consentement obligatoire. « Les décideurs ne savent pas s'ils doivent obtenir le consentement à chaque fois ou s'il suffit de suivre le processus d'engagement dans la consultation », indiquait M^{me} Singh. « Quand peut-on dire que cela suffit, comment décide-t-on si l'on a fait suffisamment d'efforts, ou pas assez, en matière d'engagement ? Où se trouve la limite ? On n'obtiendra jamais de réponse à cette question au vu de la manière dont progressent les choses, mais il faut insister sur l'importance d'un débat ouvert sur la question. »

De fait, la loi éclaire un chemin dans lequel s'était déjà engagé le pays, indiquait M^{me} Singh. « Nos gouvernements sont le reflet de notre société et du chemin qu'elle emprunte, et la politique ne se dirigeait pas vers un espace qui n'allait pas adopter la DNUDPA. »

Pour le chef Yakeleya, cette loi revêt une grande importance. « Le Canada s'est enfin réveillé. Les propriétaires d'origine ne partiront pas, nous avons des terres, nous avons des ressources, et les propriétaires terriens doivent faire partie du débat. L'application de la DNUDPA s'est beaucoup trop fait attendre - 153 ans pour être exact. » 

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The devil underground

By Angelica Zagorski

Deep inside the dark corners of Bolivia's deadliest mine, an average of 14 lives are claimed each month. The deaths could be attributed to either the effects of continuously breathing toxic dust and fumes or unsafe working conditions underground, but to the locals it is the work of the devil-like deity known as El Tío.

El Tío, meaning "the uncle," is worshipped by miners in the Cerro Rico mountain. Legend has it that any deaths that take place in the mine are said to have been caused by his hunger.

The Cerro Rico mountain was once the location of the greatest silver deposits on earth, but it carries a dark history. Between four and eight million aboriginal Quechuan peoples and enslaved Africans are estimated to have died mining the mountain, earning it the name "The Mountain that Eats Men."

The underground cult of El Tío comes from an ancient myth told by the Spanish Catholics. When they arrived in the 16th century and exploited the mountain, the Incas and Indigenous peoples were forced to work in brutal conditions, and many died from overexertion. The Spaniards did not want to enter the mines themselves, so they told the slaves that a lack of obedience to their orders would cause a vengeful devil to wreak chaos on the mountain. The manifestation of that myth became El Tío, a devil who would intervene on their behalf for a small price. The artisanal miners still working in the tunnels of Cerro Rico pay homage to El Tío to this day to protect them from their notoriously hazardous workplace.

El Tío is represented by a statue decorated to resemble depictions of the Christian devil. The statues are seated in active mine shafts, and miners must deliver gifts to El Tío if they wish to survive another day in the mine. Over 600 shrines of El Tío exist in the mines today.

The statues are as large as an average human and have sharp horns growing from their heads. Some miners replace the eyes of the statues with light bulbs and use shards of metal ore, glass, or crystal to decorate their grimacing smiles. At the centre of each statue is a lump of silver representing what the miners risk their lives for each day.

El Tío accepts offerings in many forms. On Tuesdays and Fridays, the miners rest with the devil and share a drink, smoke or



Photo by Jkratt5

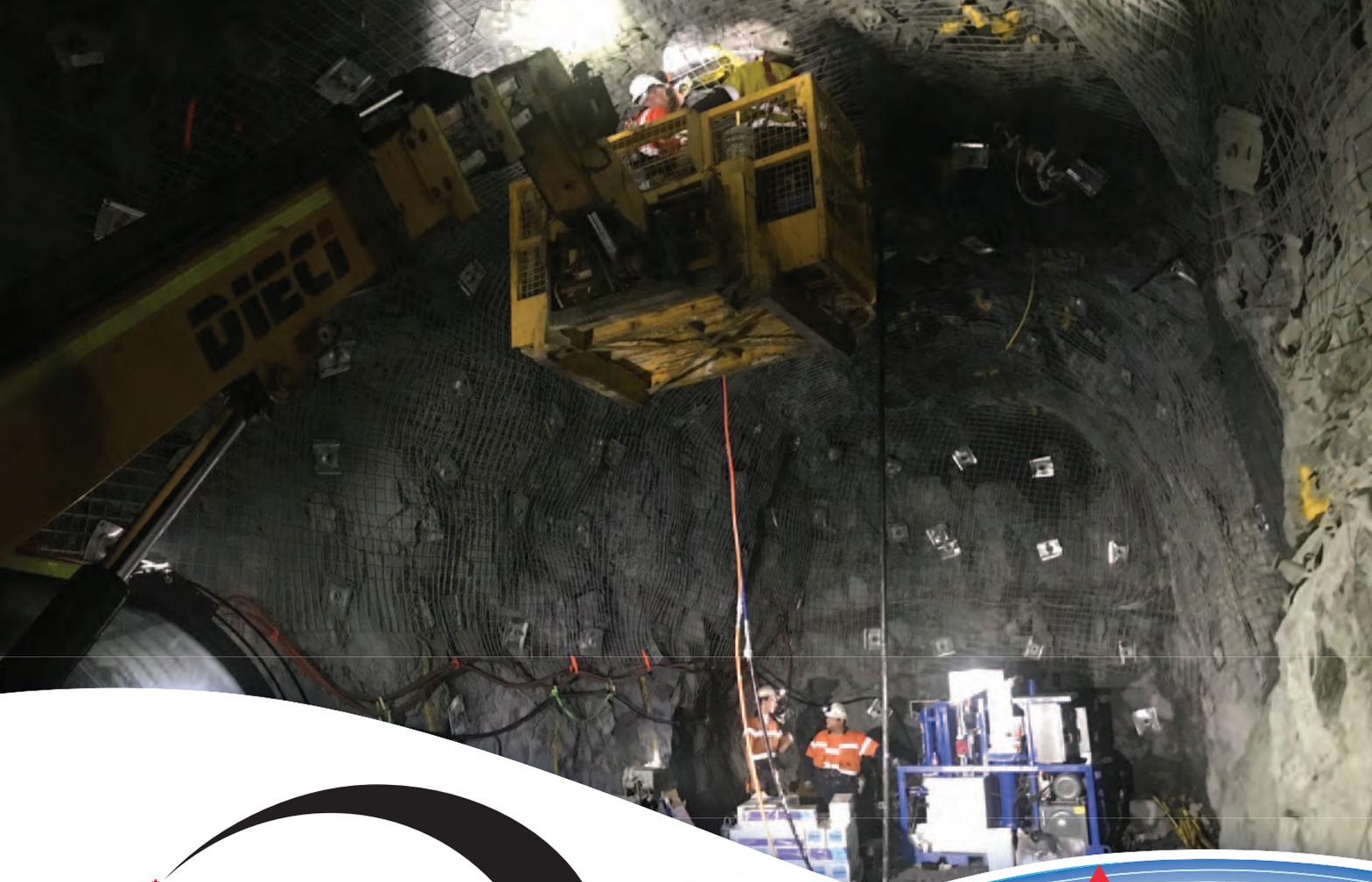
Over 600 statues of El Tío exist in the mines at Cerro Rico.

some coca. This sharing of indulgences satisfies his appetite and prevents him from causing death in the mines. Each Tuesday during Carnival, the miners perform cha'alla, soaking the earth around the statue with alcohol, draping its neck with garlands and leaving offerings of food and drink.

On the first of August is k'araku, a ceremonial offering where llamas are sacrificed at the entrance of the mines and their blood is collected in large bowls and splashed across the mine entrances. At other times, the sacrifice can take on a different form, with miners placing a live llama in a mine cart with sweets and other offerings before dousing it in alcohol and kerosene, setting it ablaze and sending it towards the depths of the mines. These offerings not only serve to satiate El Tío's hunger, but generate prosperity underground.

Devil worship is sacrilegious in Catholicism and most Bolivian miners are devout Catholics and regular churchgoers. Practically speaking, a barrier separates the two entities quite literally in the hearts and minds of the miners: God alone is worshipped above ground, while El Tío is worshipped underground – neither deity can be mentioned outside of its place.

Today, the statues of El Tío are symbols of fear, colonialism, danger and power, but they also act as relics of poetic expression by the oppressed that help miners find peace going to work in the dangerous Cerro Rico mines, as long as El Tío isn't hungry. **CIM**



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